Owner's Manual

ACE3600 RTU

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MOTOROLA

EUROPEAN UNION DIRECTIVE 2002/95/EC CONFORMANCE STATEMENT

Hereby, Motorola declares that these products comply with RoHS European Directive no. 2002/95/EC (Restriction of the use of Hazardous Substances) and WEEE Directive no. 2002/96/EC (Strategy of Waste management), with the exception of models listed in Appendix B.

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CONTENTS

GLOSSARY

ACE	Advanced Control Equipment
AI	Analog Input
AO	Analog Output
AWG	American Wire Gauge
DCD	Data Carrier Detect
DFM	Direct Frequency Modulation
DI	Digital (Discrete) Input
DNP	Distributed Network Protocol
DO	Digital (Discrete) Output
DPSK	Differential Phase Shift Keying
EMI	Expansion Microcode Interface
EPP	Environmentally Preferred Product
ESD	Electrostatic Discharge
EU	European Union
FCC	Federal Communication Commission
FEP	Front End Processor (MCP-M, MCP-T, or FIU)
FET	Field Effect Transistor
FPGA	Field Programmable Gate Array
FSK	Phase Shift Keying
FIU	Field Interface Unit
GND	Ground
GPRS	General Packet Radio Service
GPS	Global Positioning Satellite
GSM	Global System for Mobile Communications
GW	ACE IP Gateway
HV	High Voltage
HW	Hardware
IEC	International Electrotechnical Commission
IO (I/O)	Inputs Outputs
IP	Internet Protocol
IPGW	IP Gateway

LAN	Local Area Network
LED	Light Emitting Diode
MCC	Master Control Center
MCP-M	Motorola Communication Processor – MODBUS
MDLC	Motorola Data Link Communication
MODBUS	MODICON BUS Protocol
MOSCAD	Motorola SCADA
MOSCAD-L	Motorola SCADA-Light
NEMA	National Electrical Manufacturers Association (issues enclosure standards)
NTP	Network Time Protocol
OPC	Open Connectivity
OVF	Overflow
PC	Personal Computer
PLC	Programmable Logic Controller
PPC	Power PC
PPH	Pulse per Hour
PPM	Parts Per Million
PPP	Point-to-Point Protocol
PPS	Pulse per Second
PSTN	Public Switched Telephone Network
RAM	Random Access Memory
RF	Radio Frequency
ROM	Read Only Memory
RST	Reset
RTS	Request to Send
RTU	Remote Terminal Unit (can be MOSCAD or MOSCAD-L)
RX	Receive
SCADA	Supervisory Control and Data Acquisition
SBO	Select Before Operate
SDRAM	Synchronous Dynamic Random Access Memory
SNMP	Simple Network Management Protocol
SNTP	Simple Network Time Protocol
SPDT	Single Pole Double Trigger
SPST	Single Pole Single Trigger

STS	System Tools Suite
SW	Software
TB	Terminal Block
TCP	Transmission Control Protocol
TDPSK	Trunked Differential Phase Shift Keying
TX	Transmit
UDF	Underflow
UDP	User Datagram Protocol
UHF	Ultra High Frequency
USB	Universal Serial Bus
VHF	Very High Frequency
WAN	Wide Area Network
WB	Wire Break

DESCRIPTION

Product Overview

The ACE3600 is a programmable Remote Terminal Unit (RTU). Almost any automation task can be implemented with a suitable choice of ACE3600 components. Typically the RTU monitors and controls local equipment and communicates with a control center and with other RTUs in the system. The ACE3600 is the newest Motorola SCADA (MOSCAD) RTU, a member of MOSCAD family of RTUs and Control Center Front End Processors.

The ACE3600 System Tools Suite (STS) can be run on a local or remote PC to perform all the setup, programming and monitoring operations such as RTU configuration, system/application, download, monitoring, etc.

Features of the ACE3600

The ACE3600 combines all the advantages of the legacy MOSCAD and MOSCAD-L RTUs with those of modern hardware and software technologies.

Among these are:

- A modern CPU platform with powerful microprocessor
- Real-time operating system based on Wind Rivers VxWorks OS
- Enhanced communication and networking capabilities
- Rugged modular design
- Extended operating temperature range
- Improved power supply/charger
- Modules with a high component density
- System building tools
- Interoperability with legacy MOSCAD family RTUs

General Description

The ACE3600 RTU is a modular unit, comprised of removable modules installed in a multi-slot frame. These modules include

- Power supply
- CPU
- I/O modules

The basic (default) model includes one power supply and one CPU module. The number of I/O modules is selected as an option of the base model.

Figure 1-1 provides a general view of the ACE3600 RTU with five I/O modules.

Figure 1-1 ACE3600 RTU – General View

I/O Module Options

The following types of I/O modules are available:

- Digital Inputs (DI), including High Voltage
- Digital Outputs (DO), including High Voltage
- Analog Inputs (AI)
- Analog Outputs (AO)
- Mixed I/O
- Mixed Analog

Communication Interfaces

The ACE3600 CPU includes the following serial ports:

- Configurable RS232 or RS485 serial port
- Configurable RS232 with GPS receiver support (for time sync)
- Ethernet 10/100 Mb/s (ACE3600 CPU 3640, CPU 3680 models)

- Two USB full speed host ports (12 Mbs) for MotoTrbo radios only (ACE3600 CPU 3680 and ACE IP Gateway only)
- One USB device port (ACE3600 CPU 3680 and ACE IP Gateway only) (future option)

Two additional plug-in ports can be added to the CPU. The following types of communication modules are available for the plug-in ports:

- RS232
- RS485
- General radio interface (Conventional or Trunking, DPSK 1200, FSK 2400, DFM 4800)
- Ethernet 10 Mb/s
- Ethernet 10/100 Mb/s (on plug-in Port 1 only)

ACE3600 RTU Construction

The ACE3600 is available in various structures:

- Frame which can accommodate a varied number and type of modules
- Metal chassis which accommodates the frame, and optional radios, backup battery and communication interfaces
- Protective housing which accommodates the frame, and optional radios, backup battery and communication interfaces (suitable for outdoor installation)

The ACE3600 frame consists of the following elements:

- Plastic slots which accommodate the power supply, CPU and I/O modules, and backplane bus motherboard
- Mounting plate for attaching the plastic slots together and mounting the frame on a wall
- Backplane bus motherboard which connect the modules to each other via the signal buses and connects the modules with operating voltages
- Power junction box for AC or DC power source and ground connections

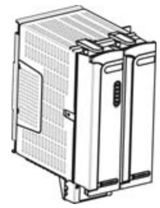
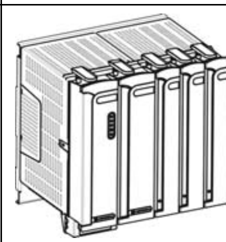
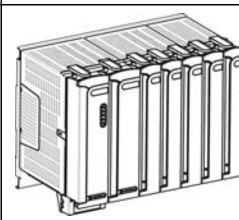
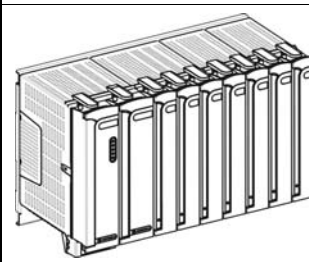
A frame can be mounted on the wall or installed in a 19” rack or customer enclosure. For more information, see the Installation chapter below

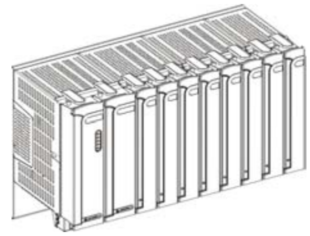
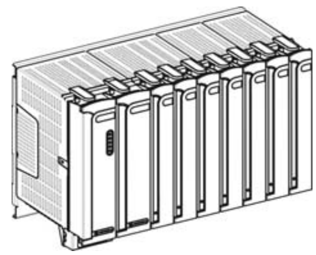
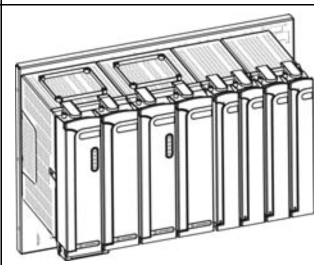
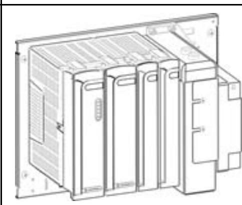
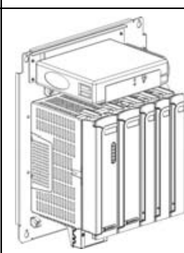
The ACE3600 frame can include wide or narrow plastic slot units:

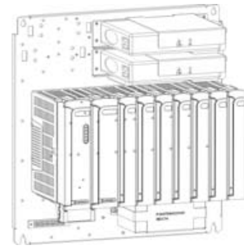
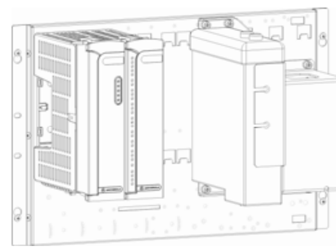
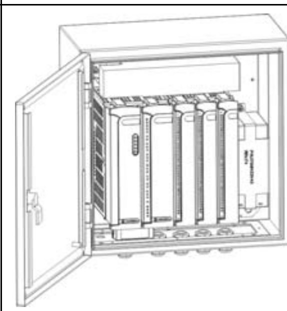
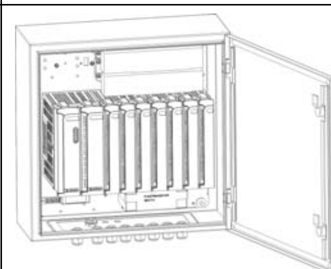
- Wide slot unit - can hold a power supply and a CPU or up to three I/O modules
- Narrow slot unit - can hold up to two I/O modules

RTU Options

Each RTU can include a number of options, including portable and mobile radios, and plastic accessory boxes with interface card for communication, etc.

Housing/Mounting Type	Capacity/Options	Illustration
No I/O slot frame Basic (default) model. Can be installed on a wall.	Power supply and CPU Can be ordered with metal chassis or housing options. Can be ordered with 19" frame metal back.	
2 I/O slot frame Can be installed on a wall.	Power supply and CPU, up to 2 I/Os Can be ordered with small metal chassis.	
3 I/O slot frame Can be installed on a wall.	Power supply and CPU, up to 3 I/Os Can be ordered with metal chassis or housing. Can be ordered with 19" frame metal back.	
5 I/O slot frame Can be installed on a wall.	Power supply and CPU, up to 5 I/Os Can be ordered with large metal chassis or housing. Can be ordered with 19" frame metal back.	
7 I/O slot frame Can be installed on a wall.	Power supply and CPU, up to 7 I/Os Can be ordered with large metal chassis or housing.	

Housing/Mounting Type	Capacity/Options	Illustration
8 I/O slot frame Can be installed on a wall or in 19" rack/enclosure.	Power supply and CPU, up to 8 I/Os Can be ordered with metal chassis option for accessories: 6.5 or 10 Ah Lead-Acid backup battery 1 radio; up to 4 accessory boxes. For all possible combinations, see 19" Metal Back Installation Combinations in the Installation chapter below.	
I/O expansion frame 2 I/O slot, 3 I/O slot, 5 I/O slot, 7 I/O slot, or 8 I/O slot	I/O expansion power supply, I/O expansion module, up to 8 I/Os. Can be connected to the main RTU frame. Can be ordered with large metal chassis or housing.	
Redundant CPU and power supply frame Can be installed on a wall, in housing, or in 19" rack/enclosure.	2 power supplies and 2 CPUs, 4 I/Os. Can be ordered with large metal chassis, housing or 19" frame metal back.	
Small metal chassis Enables installation of radio, backup battery and other accessories. Can be installed on a wall or in housing.	Power supply and CPU, up to 2 I/Os, 1 mobile/portable radio, 6.5Ah Lead-Acid backup battery; 1 accessory box can be installed in place of the radio.	
Medium metal chassis Enables installation of radio, backup battery and other accessories. Can be installed on a wall or in housing.	Power supply and CPU, up to 3 I/Os, 1 mobile/portable radio, 1 accessory box, 6.5 Ah Lead-Acid backup battery	

Housing/Mounting Type	Capacity/Options	Illustration
Large painted metal chassis Enables installation of radio, backup battery and other accessories. Can be installed on a wall or in housing.	Power supply and CPU, up to 7 I/Os, 1 accessory box, up to 2 mobile/portable radios, 6.5 or 10 Ah Lead-Acid backup battery	
19" frame metal back Enables installation of radio, backup battery and other accessories. Can be installed in 19” rack or on a wall.	Power supply and CPU, 0, 3, 5, or 8 I/Os, 1 radio, 6.5 or 10 Ah Lead-Acid backup battery, and up to 4 accessory boxes. (Not all combinations are valid together.) Can be ordered with ACE IP Gateway, power supply, radio, 6.5 or 10 Ah Lead-Acid backup battery and up to 2 accessory boxes. For all possible combinations, see 19" Metal Back Installation Combinations in the Installation chapter below.	
Small NEMA 4X/IP66 housing Enables installation of radio, backup battery and other accessories. Can be installed on a wall.	Power supply and CPU, up to 3 I/Os, 1 mobile/portable radio, 1 accessory box, 6.5 Ah Lead-Acid backup battery	
Large metal NEMA 4X/IP66 housing Enables installation of radio, backup battery and other accessories. Can be installed on a wall.	Power supply and CPU, up to 7 I/Os, 1 accessory box, up to 2 mobile/portable radios, 6.5 or 10 Ah Lead-Acid backup battery	

For installation instructions of each housing/mounting type, see the Installation chapter.

For information on I/O expansion, see the I/O Expansion chapter.

For the dimensions and weight of each combination, see Appendix A: General Specifications.

For a detailed list of all ACE3600 options, see the ACE3600 price pages and ordering information.

For a detailed description of the individual modules, see the appropriate chapter below.

RTU Components

The ACE3600 RTU can include the following components.

Component	Function	Notes
Power supply module	Converts the main AC or DC power source to the voltages required by the modules, radio/modems and accessories. Charges the backup battery and switches to the battery voltage when the main power fails (in models with charger.)	See Power Supply Module and Backup Battery chapter.
CPU module	Stores and runs the user application program, stores data collected by the I/O modules and communicates with the control center, RTUs and other devices via the communication ports.	See CPU Module chapter.
CPU plug-in port	Enables adding various communication ports to the CPU modules.	See CPU Module chapter.
CPU plug-in SRAM	Provides static RAM.	See CPU Module chapter.
I/O module	Matches between the ACE3600 and signals of various types/levels. Interfaces between the ACE3600 and the process signals.	See I/O Modules chapter.
Terminal blocks (TB)	Connects the signals to the I/O modules.	See I/O Modules chapter.
Plug-in 24V DC power supply	Enables adding 24 V floating power supplies to I/O modules for contact “wetting” and sensor operation.	See I/O Modules chapter.

Component	Function	Notes
I/O expansion module	Connects the I/O modules on an I/O expansion frame to the CPU module on the RTU's main frame (frame 0), directly or via an expansion LAN switch).	See Expansion Module chapter.
I/O expansion power supply	Connects 12V power and 12V DO from the power supply on the RTU's main frame to an I/O expansion frame, or from one I/O expansion frame to another.	See Expansion Power Supply Module chapter.
I/O expansion LAN switch	One switch enables connection of up to seven expansion frames to the main frame CPU. Two switches allow connection of up to thirteen expansion frames to the main frame CPU.	See Expansion LAN Switch chapter.
ACE IP Gateway module	Serves as a front end unit between ACE3600/MOSCAD RTUs and control center SCADA clients using TCP/IP protocol.	See ACE IP Gateway Module chapter.
TB holder kit	Holds Module TBs.	See I/O Modules chapter.
Cable with TB holder	A cable to connect signals to the I/O modules.	See I/O Modules chapter.
Backup battery	Enables backup RTU operation when main power fails.	See Power Supply Module and Backup Battery chapter.
Radio installation kit	Mechanical support and cables that enable installation of radio.	See Radio Types and Installation Kits chapter.
RS485 Connection Box	Enables connection of up to 6 devices to the RS485 port on the CPU (2W multi-drop).	See the RS485 Connection Box chapter.

Component	Function	Notes
RTU to PC RS232 cable	Enables connection of the RTU to a PC via the RS232 port.	For use of the ACE3600 Software Tools Suite (STS) to perform operations such as RTU configuration, system/application, download, monitoring, etc. See the ACE3600 STS User Guide.
RTU to PC Ethernet cable	Enables connection of the RTU to a PC via the Ethernet port.	For use of the ACE3600 Software Tools Suite (STS) to perform operations such as RTU configuration, system/application, download, monitoring, etc. See the ACE3600 STS User Guide.
Ethernet cable	Enables the following connections: 1. CPU to LAN switch 2. LAN switch to expansion frame 3. LAN switch to LAN switch	See Expansion Module chapter.
Ethernet cross cable	Enables the following connections: 1. A single I/O expansion frame directly to the RTU main frame. 2. PC (STS) directly to one of the CPU Ethernet ports.	See Expansion Module chapter.

Model Options and Accessories

F7500 - ACE3600 System Tools Suite Software

F7600 - ACE3600 ‘C’ Toolkit Software

The full list of ACE3600 options and accessories are listed in the ACE3600 System Planner.

Product Safety and RF Exposure

Before using an ACE3600 RTU model with a radio installed, read the operating instructions and RF exposure booklet for the specific radio contained in the product.

INSTALLATION

General

The ACE3600 RTU is shipped from the factory with the modules and plug-in ports assembled. The RTU frame is ready for mounting directly on a wall or in a customer's enclosure. The eight I/O frame can be installed on a 19" rack.

Modules can be added to the slots in a frame before or after mounting the RTU on a wall/enclosure.

WARNING

Installation of the ACE3600 should be done only by authorized and qualified service personnel in accordance with the US National Electrical Code. Only UL Listed parts and components will be used for installation. Use UL Listed devices having an environmental rating equal to or better than the enclosure rating to close all unfilled openings.

If the installation involves high-voltage connections, technicians must be specifically qualified to handle high voltage.

If the I/O connections are powered by a hazardous voltage (>60VDC or >42Vpeak), all inputs should be defined as hazardous and the unit must be installed in a restricted access area for service personnel only.

If the I/O connections are powered by a safety extra low voltage (SELV) (<60VDC or <42Vpeak), all inputs should be defined SELV.

INSTALLATION CODES

This device must be installed according to the latest version of the country's national electrical codes. For North America, equipment must be installed in accordance to the applicable requirements in the US National Electrical Code and the Canadian Electrical Code.

INTERCONNECTION OF UNITS

Cables for connecting RS232 and Ethernet Interfaces to the unit must be UL-certified type DP-1 or DP-2. (Note- when residing in a non LPS circuit.)

OVERCURRENT PROTECTION

A readily accessible Listed branch circuit overcurrent protective device rated 20 A must be incorporated in the building wiring.

CAUTION

External wiring which connects an I/O module to instruments/devices may not exceed 42.67m (140 feet).
If the ACE3600 is subject to high levels of shock or vibration, you must take suitable measures to reduce the acceleration or amplitude. We recommend that you install the ACE3600 on vibration-damping materials (for example, rubber-metal anti-vibration mountings).

METAL PARTS OF THE POWER SUPPLY MAY BE VERY HOT.

After removing the power supply module, allow the metal parts to cool down before servicing the unit.

NOTE

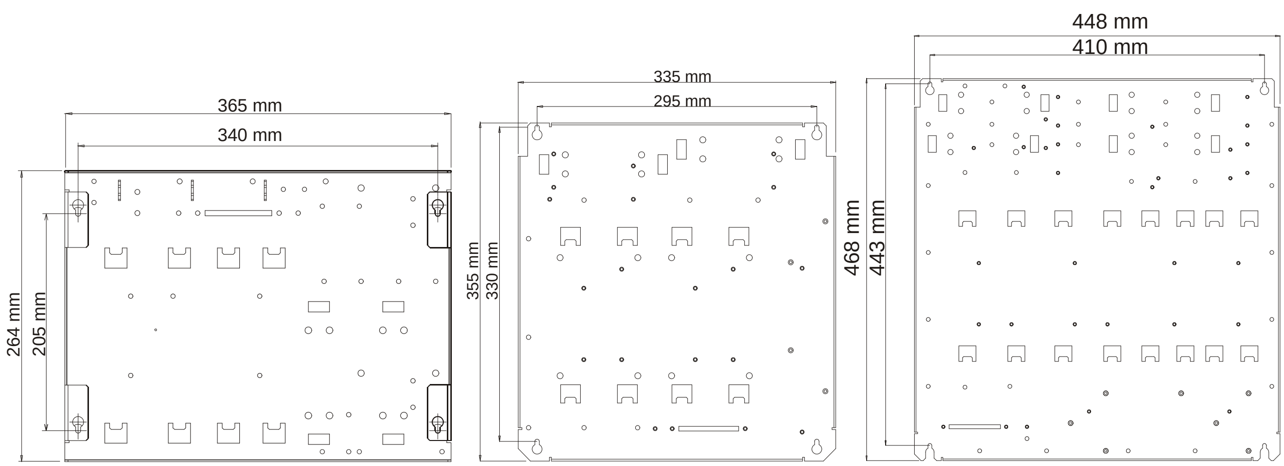
A TORX screwdriver is required for installation.

Mounting the ACE3600 Frame on a Wall

WARNING

Before drilling holes for mounting the frame, make sure there are no electrical wires installed inside the wall at the holes' location.

Four holes are provided, one in each corner of the RTU frame, for wall mounting the RTU. Figure 2-1, Figure 2-2, and Figure 2-3 show the dimensions of the various frames/metal chassis and the distances between the holes. For convenient installation of the ACE3600 RTU on a wall, allow an additional 6 cm (2.4") (in W, H) and 7 cm (2.75") (in D) around the plate.



Small Metal Chassis **Medium Metal Chassis** **Large Metal Chassis**

Figure 2-1 Small//Medium/Large Metal Chassis Installation Dimensions and Screw Holes for Installation

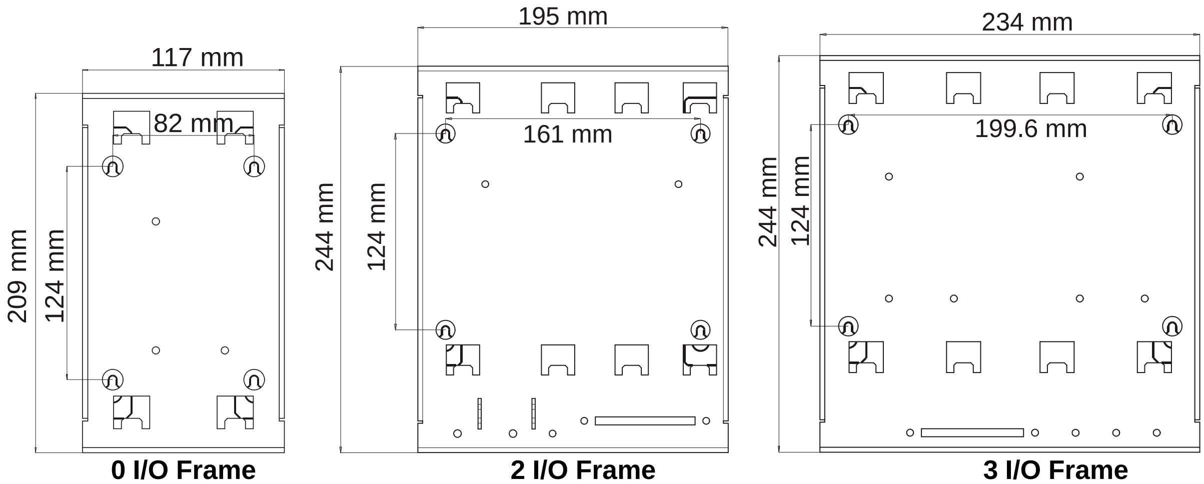


Figure 2-2 No I/O, 2 I/O, and 3 I/O Frame Installation Dimensions and Screw Holes for Installation

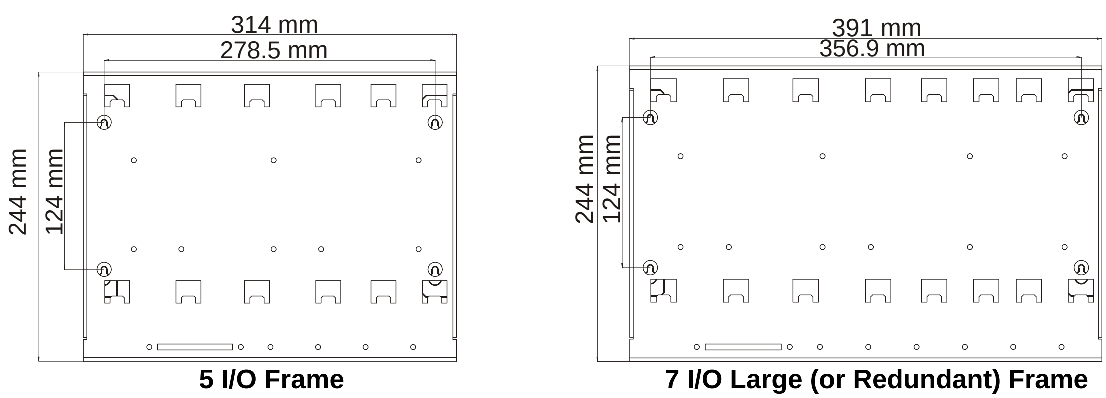


Figure 2-3 5 I/O and 7 I/O Frame Installation Dimensions and Screw Holes for Installation

Note: The default redundant CPU and power supply frame is the same size as the 7 I/O frame.

The following screw mount installation procedure should be used to install all ACE3600 frames (with or without a metal chassis) on a wall, except the 8 I/O (19") frame. For the 8 I/O frame, see Installing the ACE3600 in a 19" Rack and Mounting the ACE3600 8 I/O Frame on a Wall below.

Procedure 2-1 How to Mount the RTU Frame on a Wall

1) Drill four holes in the wall at the horizontal and vertical distances shown in Figure 2-1, Figure 2-2, and Figure 2-3.

2) Insert M4 screws (not supplied) with head size DIN 7981C/ST4, 2x38mm into the holes.

3) Remove the modules from the frame.

4) Lift the RTU frame and hang over the four screws.

5) Remove the outermost modules in order to access the screws.

6) Tighten all four screws with a screwdriver to secure the frame firmly against the wall.

7) Replace the removed modules in their slots.

Installing the ACE3600 in a 19" Rack

The following screw mount installation procedure should be used to install the ACE3600 8 I/O (19") frame / 19" frame metal back in a 19" rack unit. The redundant CPU and power supply frame on a 19" frame metal back can also be installed in a 19" rack unit.

Note: The brackets for 19" rack installation are not provided with the RTU and should be ordered separately.

Procedure 2-2 How to Mount the RTU in a 19" Rack Unit

1) Using three M4 screws supplied with kit FHN7420A, attach the metal bracket (p/n 07013005001 from kit FHN7420A) to the side of the 19" frame metal back, according to the desired depth of the unit on the rack. Repeat with the second bracket on the other side of the 19" frame metal back. See Figure 2-4.

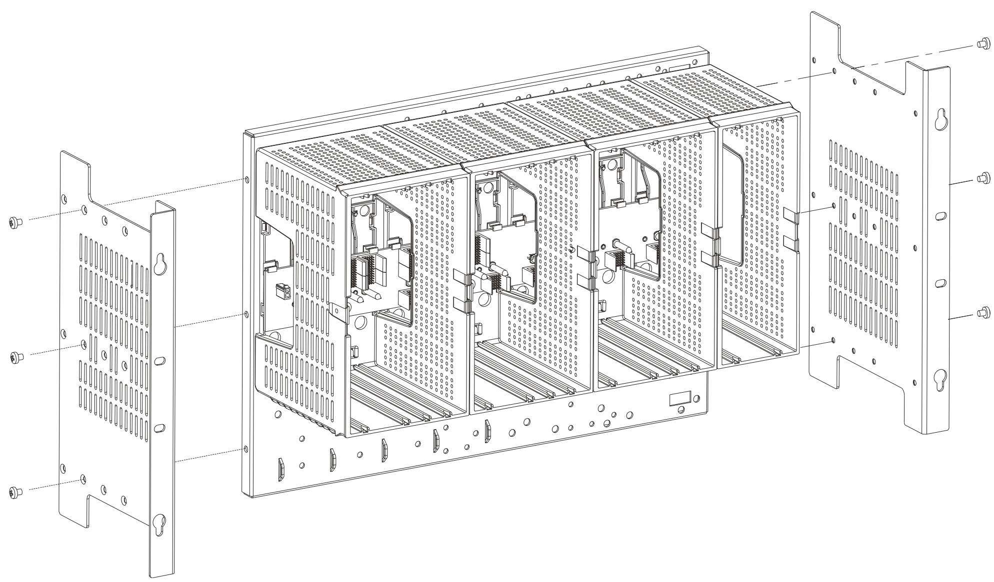


Figure 2-4 Attaching Brackets to 19" Frame - Exploded View

2) Screw one M5 screw (not supplied) into the upright of the 19" rack unit, to correspond to the top keyhole on the metal bracket. Repeat on the opposite upright. See Figure 2-5.

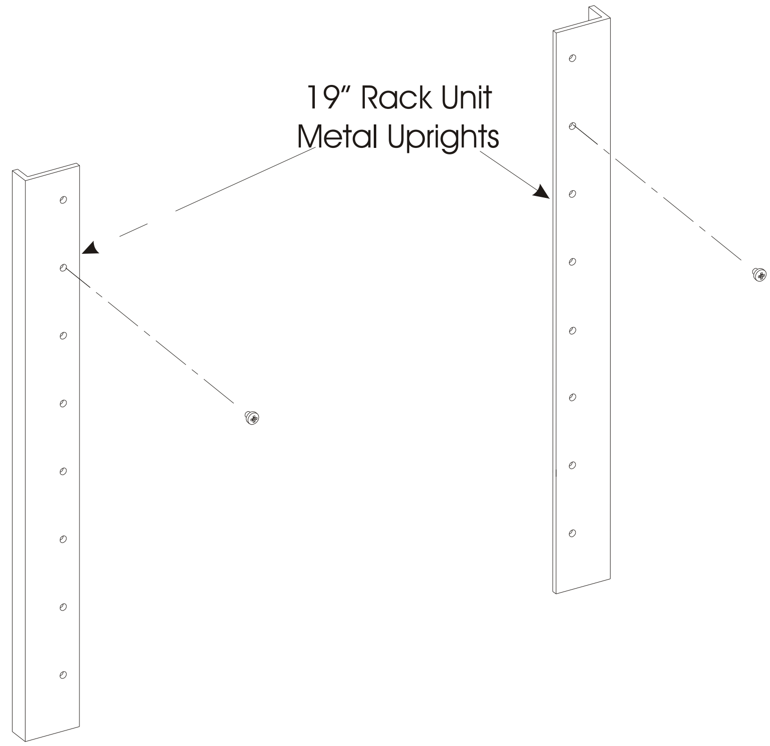


Figure 2-5 Screws for Hanging 19" Frame in Rack Unit - Exploded View

3) Align the keyholes on the brackets with the two screws on the rack metal uprights, and hang the frame on the rack metal uprights. See Figure 2-6. Tighten the two screws to the uprights.

4) To reinforce the installation, add three more M5 screws (not supplied), through the remaining three holes on the metal bracket, into the upright of the 19" rack unit. Repeat on the opposite upright. See Figure 2-6.

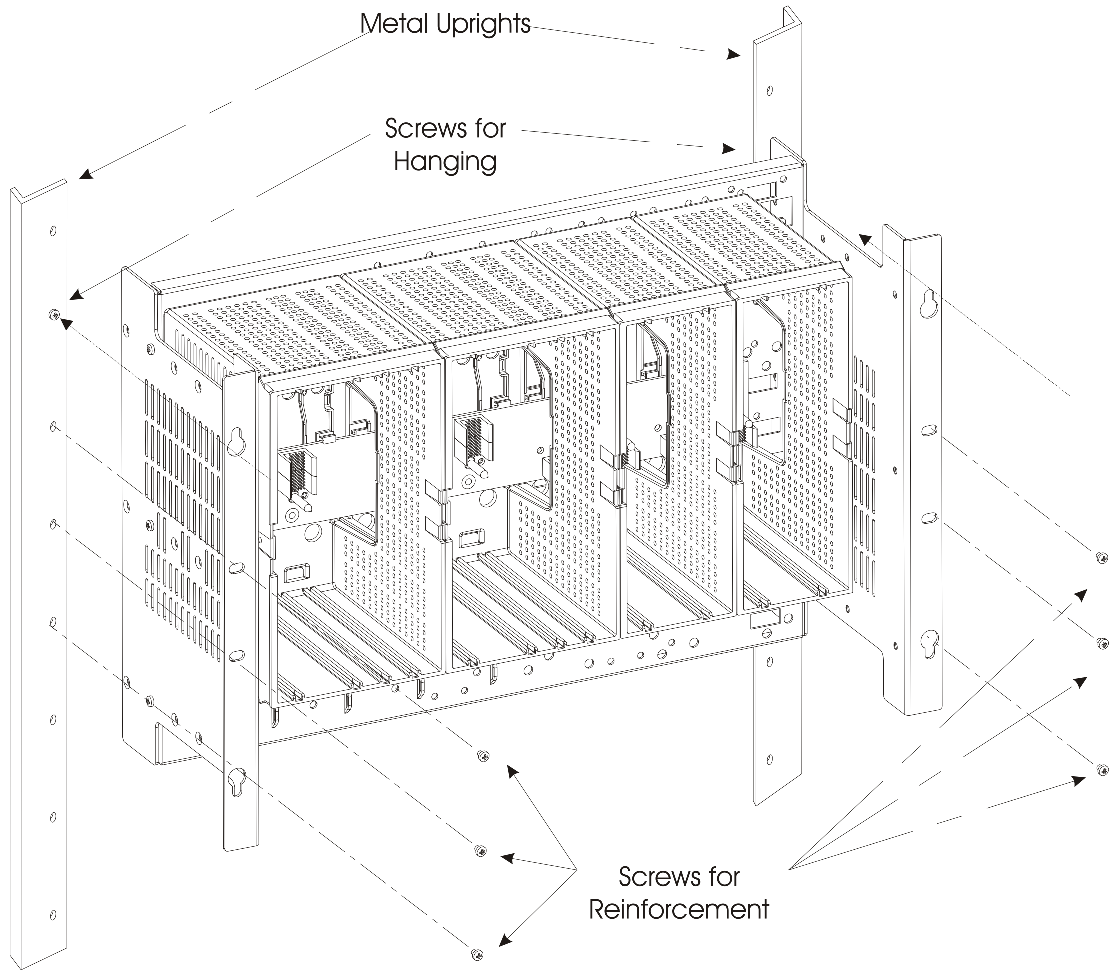


Figure 2-6 Installation of ACE3600 RTU 19" Frame in Rack Unit - Exploded View

Installing the ACE3600 in a 19" Rack (for RTUs Ordered before October 2010)

The following screw mount installation procedure should be used to install the ACE3600 8 I/O (19") frame in a 19" rack, for RTUs ordered before October 2010.

Note: The brackets for 19" rack installation are not provided with the RTU and should be ordered separately.

Procedure 2-3 How to Mount the RTU in a 19" Rack Unit

1) Press the small metal bracket into the slot of the larger bracket. See Figure 2-7.

2) Secure the two brackets together with two M5 screws (supplied), according to the desired depth of the unit on the rack. See Figure 2-7.

3) Repeat steps 1-2 for the other pair of brackets.

4) Using the supplied two screws, attach the combined brackets to the metal upright of a 19" rack unit. See Figure 2-7. Repeat on other side.

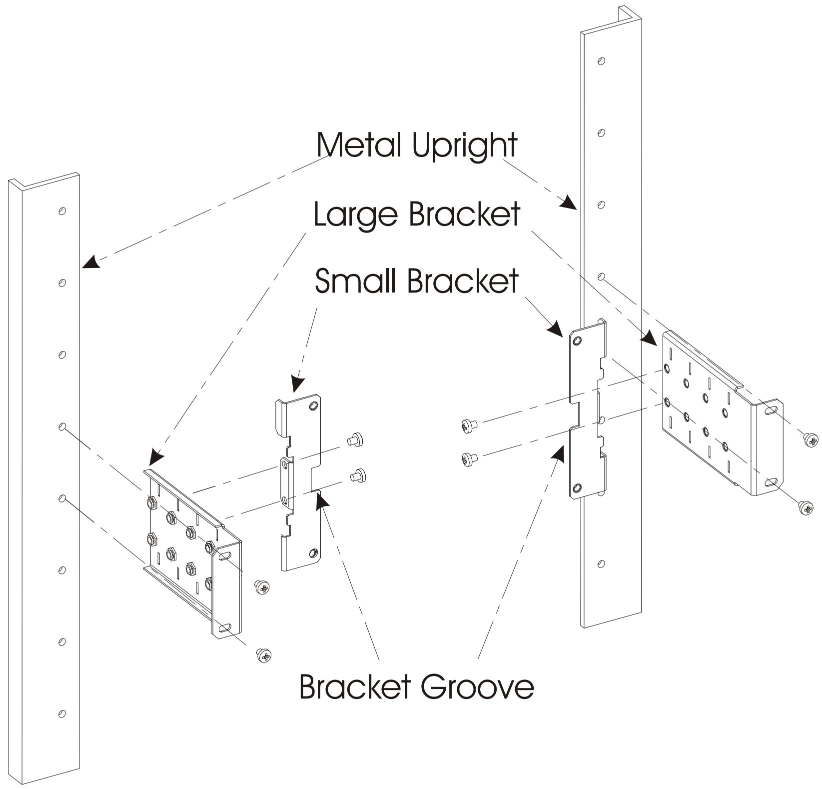


Figure 2-7 Installation of Brackets for 19" Rack Units

5) Hang the 19" metal chassis on the brackets, so that the two teeth on the back of the metal chassis hook onto the groove of the larger bracket. See Figure 2-8.

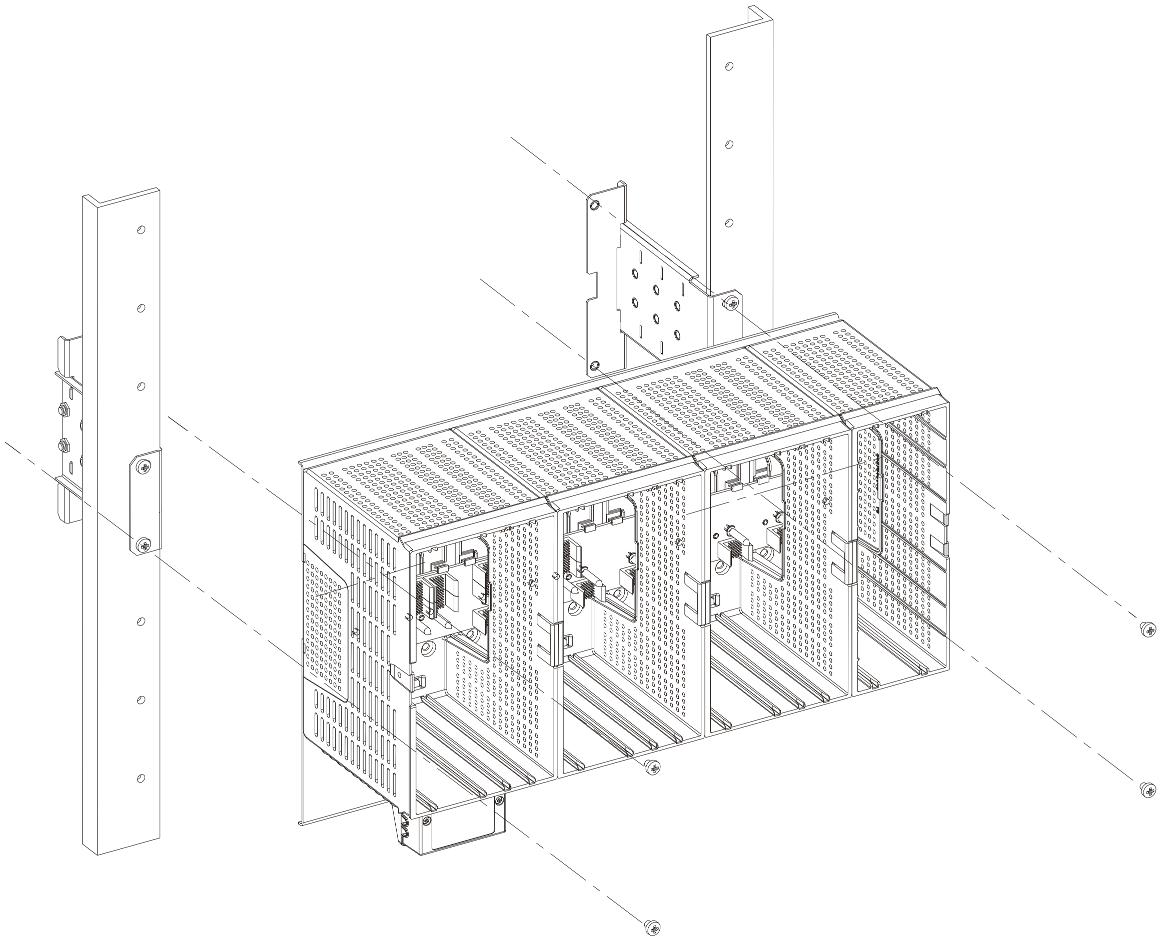


Figure 2-8 Installation of ACE3600 RTU 19" Rack- Exploded View

6) From the standard rack unit, remove the two modules from the leftmost slots and the two modules from the rightmost slots. For the 19" accessories metal chassis, no accessories need to be removed. (See Figure 2-9.)

7) Using two supplied M5 (X6) screws and a 16 cm (6.3") long screwdriver, from inside the slot secure the 19" frame metal back to the small bracket. Repeat on the second side. See Figure 2-8.

8) Replace any removed modules to their slots.

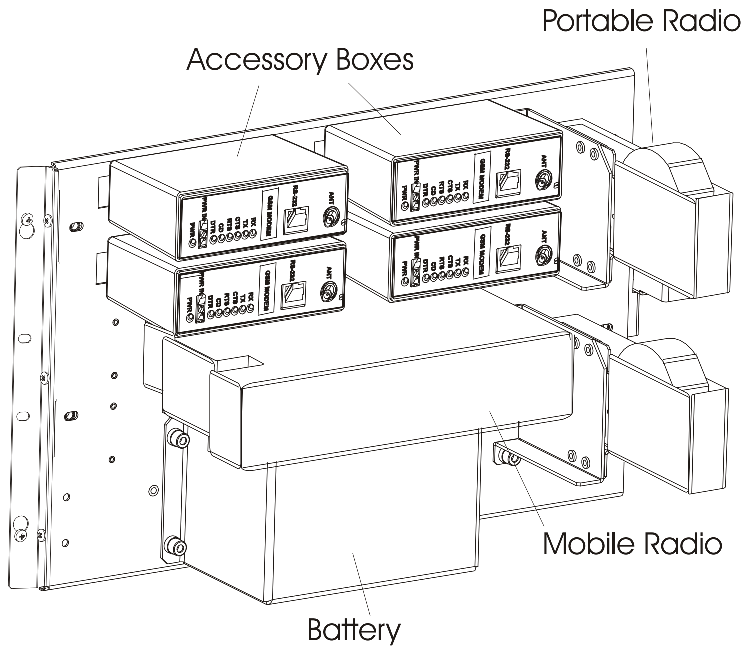


Figure 2-9 Installation of ACE3600 RTU 19" Rack Accessories - General View

Mounting the ACE3600 8 I/O Frame on a Wall

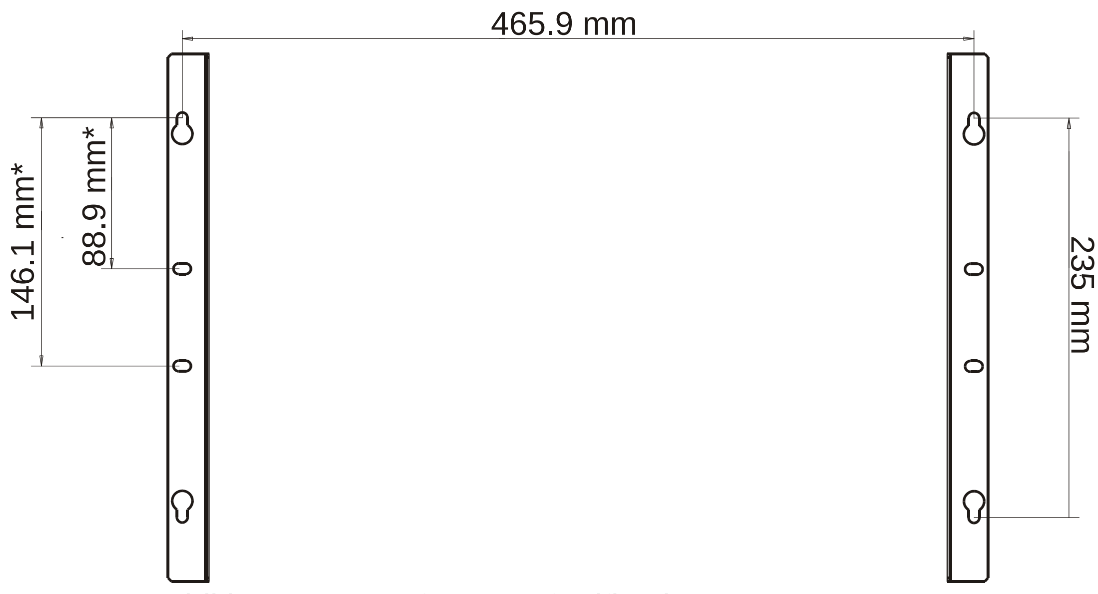


Figure 2-10 8 I/O Frame (19") Metal Back Installation Dimensions

The following screw mount installation procedure should be used to install the ACE3600 8 I/O (19") frame on the wall. The redundant CPU and power supply frame on a 19" frame metal back can also be installed in a 19" rack unit.

Note: For the 8 I/O slots option and the 19" frame metal back option, the brackets for wall mount installation are included and need not be ordered separately.

Procedure 2-4 How to Mount the RTU 19" Frame Metal Back on a Wall

1) Remove the CPU, Power Supply and I/O modules from the RTU frame.

2) Drill four holes into the wall at the horizontal and vertical distances shown in Figure 2-10. (If you choose to further secure the 19" frame, drill four additional four holes, at the distances shown in Figure 2-10.)

3) Using two M5 screws (not supplied), secure the rectangular wall mounting bracket (07013022001 from kit FHN7419A) to the wall, as shown in Figure 2-11. Repeat for the second bracket.

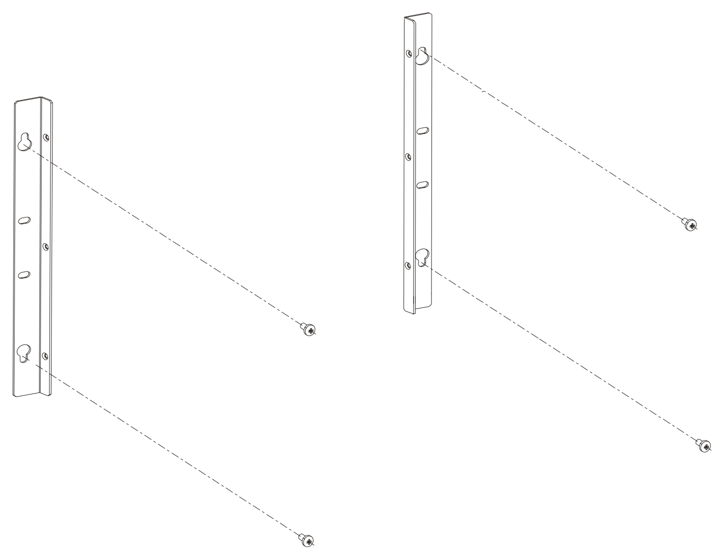


Figure 2-11 19" Frame Metal Back Bracket Installation

4) Fit the metal frame in between the two brackets, lining up the holes on the sides. (See Figure 2-12.)

5) Using three supplied M4 screws, secure the left bracket to the left side of the frame. (See Figure 2-12.) Using three more screws, secure the right bracket to the right side of the frame.

6) If you choose to further secure the 19" frame, screw two additional M5 screws (not supplied) into the two middle holes on the left bracket, as shown in Figure 2-12. Repeat for the right bracket.

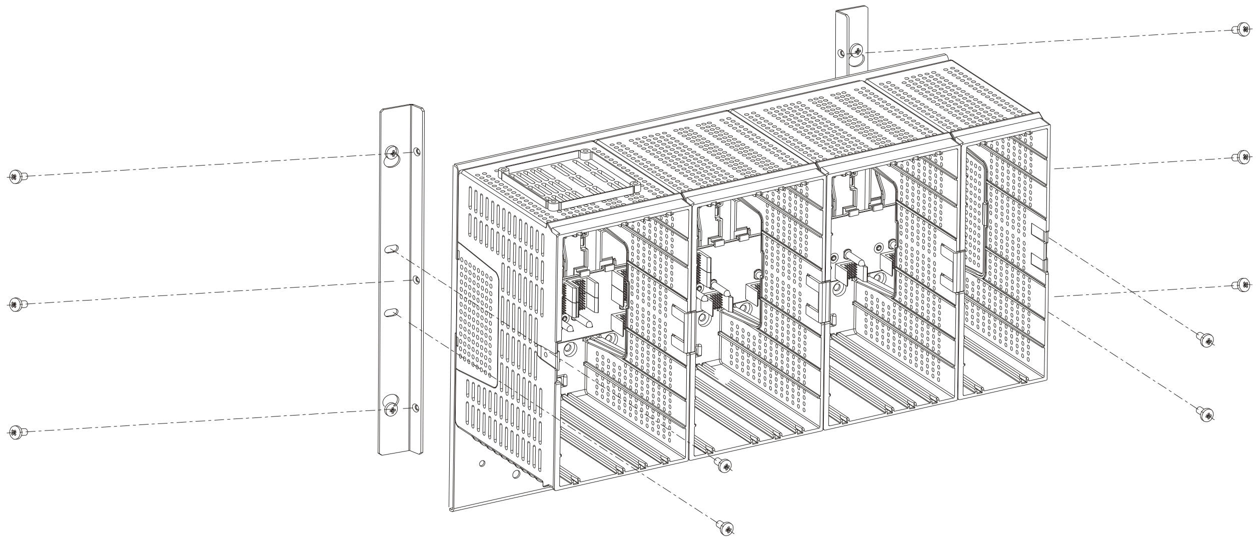


Figure 2-12 19" Frame Metal Back Installation

Mounting the ACE3600 8 I/O Frame on a Wall (for RTUs Ordered before October 2010)

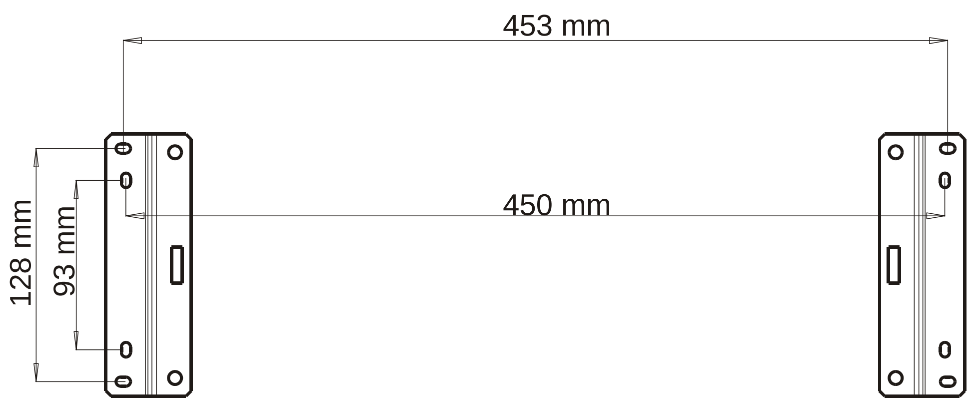


Figure 2-13 RTU Frame Metal Back Installation Dimensions

Procedure 2-5 How to Mount the RTU 19" Frame Metal Back on a Wall

The following installation procedure should be used to install the 8 I/O (19") frame on a wall, using the special wall mount brackets provided with the RTU.

1) Remove the CPU, Power Supply and I/O modules from the RTU frame.
2) Drill four holes into the wall at the horizontal and vertical distances shown in Figure 2-13.
3) Using two supplied screws, secure the rectangular wall mounting bracket to the wall. Repeat for the second bracket.

4) Hang the metal chassis on brackets so that the two teeth of the metal chassis hook onto the groove of the brackets. (See Figure 2-14.)

5) Using two M4 screws (not supplied) with head size DIN 7981C/ST4, 2x38mm screws, secure the top and bottom of the frame to the left bracket. Repeat for the right bracket.

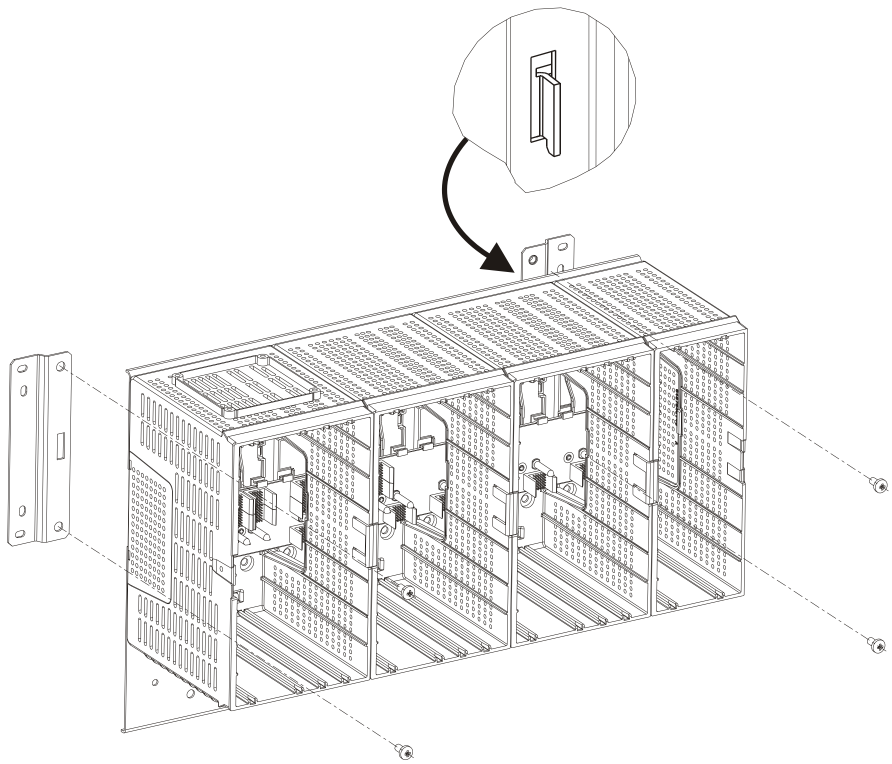


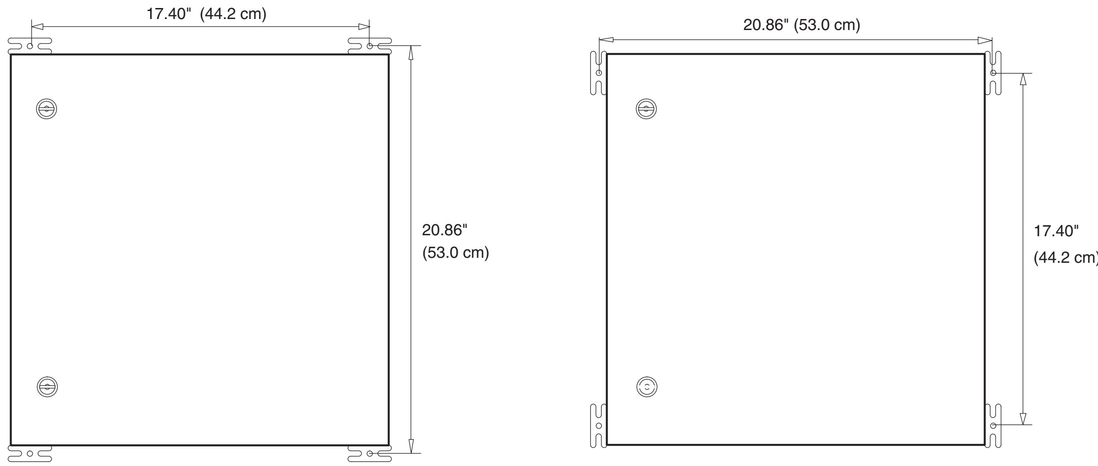
Figure 2-14 RTU Metal Chassis Installation

Mounting the ACE3600 NEMA 4 Housing on a Wall

The following screw mount installation procedure should be used to install ACE3600 frames in NEMA 4 housing on a wall.

For convenient installation of the ACE3600 RTU with the NEMA 4 housing, allow an additional 6 cm (2.4") (in W, H) and 7 cm (2.75") (in D) around the housing.

Four mounting brackets are provided, one in each corner of the RTU, for wall mounting the RTU housing (see Figure 2-15 through Figure 2-17). Figure 2-15 and Figure 2-16 show the distances between the bracket holes.



Horizontal Bracket Installation **Vertical Bracket Installation**

Figure 2-15 Large NEMA 4 Housing - Installation Dimensions

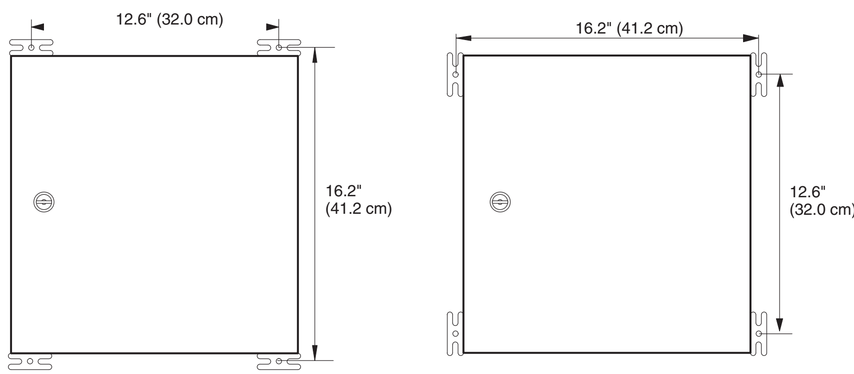


Figure 2-16 Small NEMA 4 Housing - Installation Dimensions

Procedure 2-6 How to Mount the RTU NEMA 4 Housing

1) Drill four holes in the wall at the horizontal and vertical distances shown in Figure 2-15 (for the large housing) and in Figure 2-16 (for the small housing.)

2) Using the brackets and the screws supplied in the plastic bag, fasten the mounting brackets, either horizontally or vertically, onto the four back corners of the housing. See Figure 2-17.

3) Mount the RTU onto the wall and secure with M4 screws (not supplied) with head size DIN 7981C/ST4, 2x38mm through the bracket hole. See Figure 2-17.

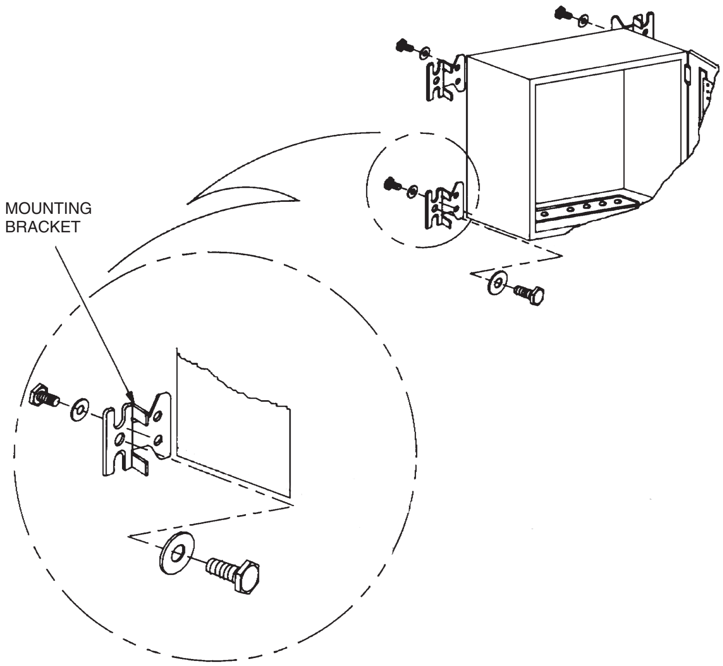


Figure 2-17 Mounting the NEMA 4 Housing

Connecting Power and Ground

All internal electrical connections except for the main power, ground and battery are performed in the factory and supplied with the RTU. The electrical interconnection diagrams are provided in the Break-Fix Procedures chapter.

The procedures for the main power, ground and battery connections are provided below.

The power and ground connections should be performed only by qualified and authorized service personnel. All power and ground connections must be in accordance with local standards and laws.

Per UL 60950 / EN 60950, install an external circuit breaker rated at 6 A between the power source and the ACE3600 Power supply.

Per UL 60950 / EN 60950, for all I/O modules connections, the maximum voltage should not exceed 60V DC or 30 V AC unless it is specifically written otherwise.

To maintain Overvoltage (Installation) Category II, install a suitable surge suppressor device in the branch circuit to limit expected transients to Overvoltage Category II values. The limits are based on IEC60664 and are also located in Table 2H of UL60950 (for mains = 150V, the transient rating is 1500V; for 150V < mains = 300V, the transient rating is 2500V; and for 300V < mains = 600V, the transient rating is 4000V).

NOTE

Make sure that the ground wire on the user cable is long enough to reach the grounding strip.

Connecting AC/DC Main Power

The power connection to all the ACE3600 power supply types is via the power junction box located on the frame beneath the power supply slot.

IMPORTANT

Safety standards require that the power cable be attached to the unit at two anchor points:

- Anchor point 1 for all units is inside the power junction box. (See Figure 2-18 below.)
- Anchor point 2 for the basic model (No I/O Slots Frame) is located on the right of the power junction box. (See Figure 2-18 below.)
  Anchor point 2 for all units with housing (other than No I/O Slots) is in the housing power cable gland. (See Figure 2-22 below.)
  Anchor point 2 for all other units without housing (other than No I/O Slots) is near the unit’s ground strip. (See Figure 2-19 below.)

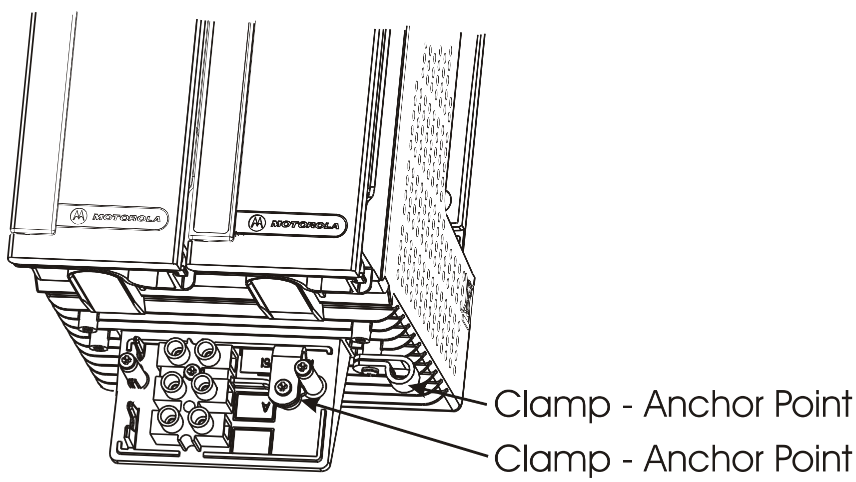


Figure 2-18 RTU on No I/O Frame – Cable Anchor Points 1 and 2

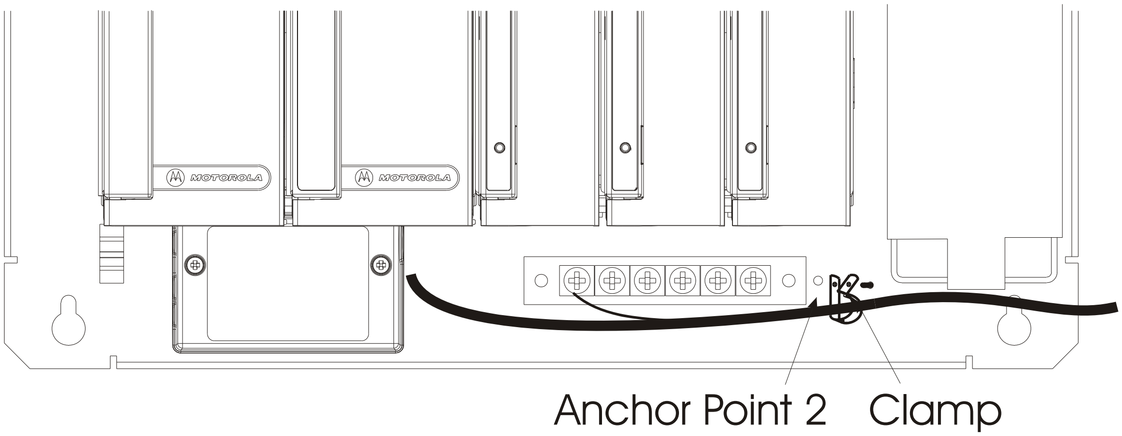


Figure 2-19 RTU on Metal Chassis – Cable Anchor Point 2

Procedure 2-7 How to Connect the RTU to Main Power Source (Units with Frames and Metal Chassis)

1) Using a screwdriver, open the power junction box cover (save the screws) and unscrew the power terminals screws inside the power junction box.

2) Thread the user's main power cable through the two supplied clamps.

3) Attach the wires of the user cable, according to the labels (~/0 for AC and +/- for DC.) For the No I/O Frame, connect the ground cable to the lower wire terminals (third pair). See Figure 2-20 and Figure 2-21.

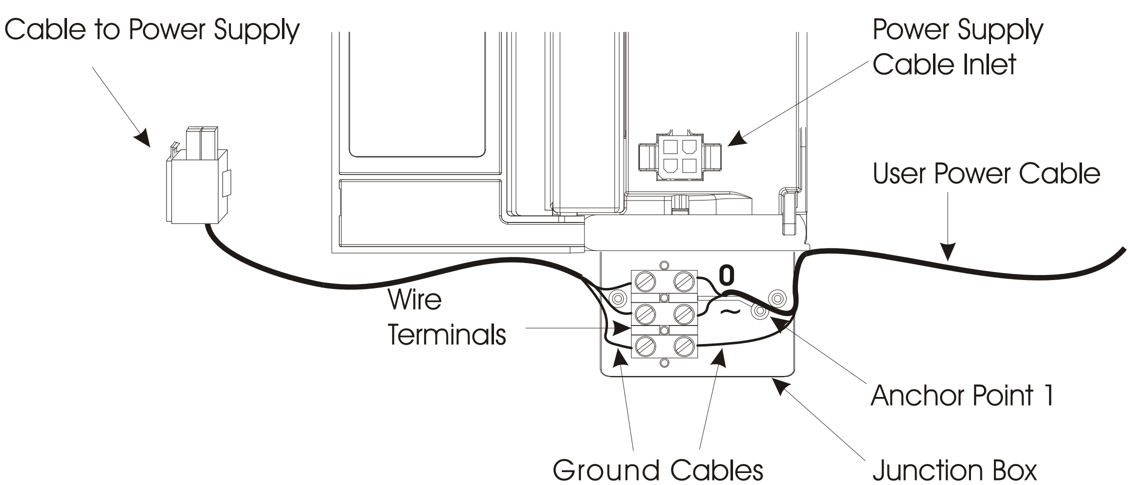


Figure 2-20 RTU Power and Ground Connections - No I/O Frame Installation

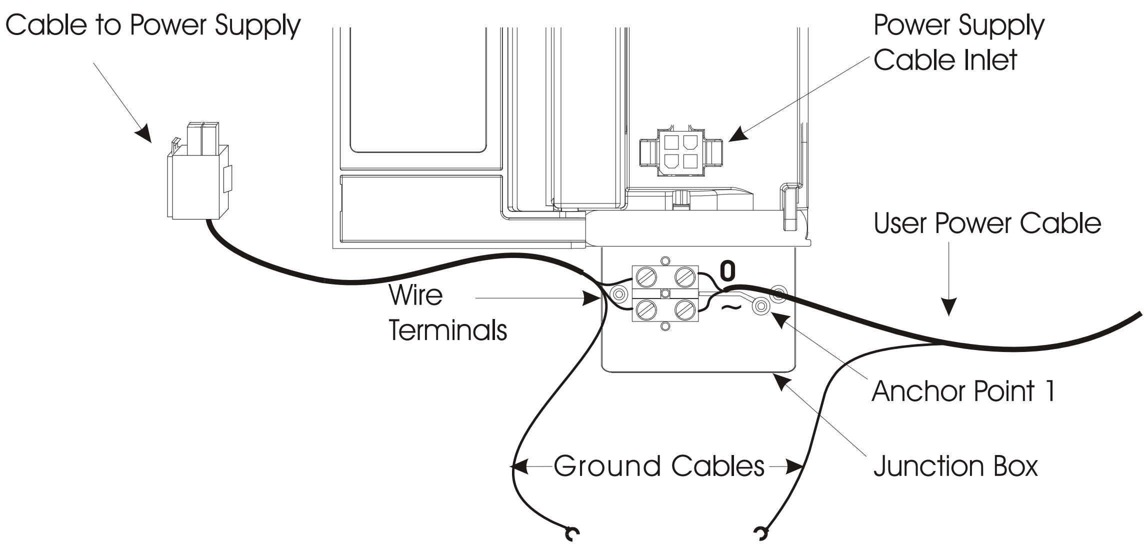


Figure 2-21 RTU Power and Ground Connections – All Other Installations

4) Pass the power cable to the right of the wire terminals inside the junction box, over the horizontal ridge.

5) Close the first clamp around the user cable and screw it onto the junction box, into the hole next to wire terminals (anchor point #1).

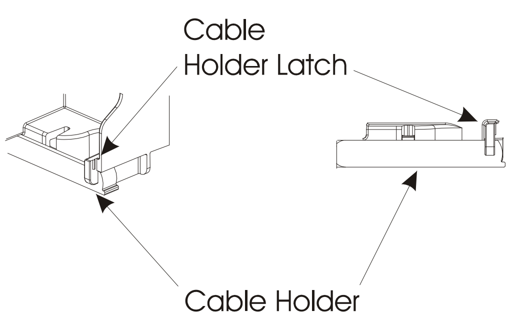
6) Close the second clamp and screw it onto the anchor point near the grounding strip (or on the bottom of the plastic to the right of the junction box in case of the No I/O Slots frame.)

7) Replace the junction box cover over the junction box.

8) Secure the junction box cover with two saved screws.

9) For all installations except the No I/O frame, loosen the two screws on the grounding strip at the bottom of the metal chassis/housing and connect the ground cable to the protective ground. Tighten the screws firmly.

10) Open the door of the power supply module and press in the cable holder downwards.



11) Plug the connector of the power supply cable (FKN8381A/3089004V64 for DC, FKN8382A/3089004V65 for AC) into the cable inlet on the power supply module (on the bottom of the front panel.) and rotate the cable holder upwards to secure.

Procedure 2-8 How to Connect the RTU to Main Power Source (Units with Housing)

1) Using a screwdriver, open the power junction box cover (save the screws) and unscrew the power terminals screws inside the power junction box.

2) Insert the rubber grommet (supplied) into the threaded plastic cable gland, and place it into the hole on the bottom of the housing (from the outside.) (See Figure 2-22.)

3) Place the nut into the same hole from inside the housing and screw the nut onto the cable gland. (See Figure 2-22.)

4) Thread the user's main power cable (110/220VAC or 24-48VDC) through the cable gland cover from below, through the cable gland, and into the housing. (See Figure 2-22.)

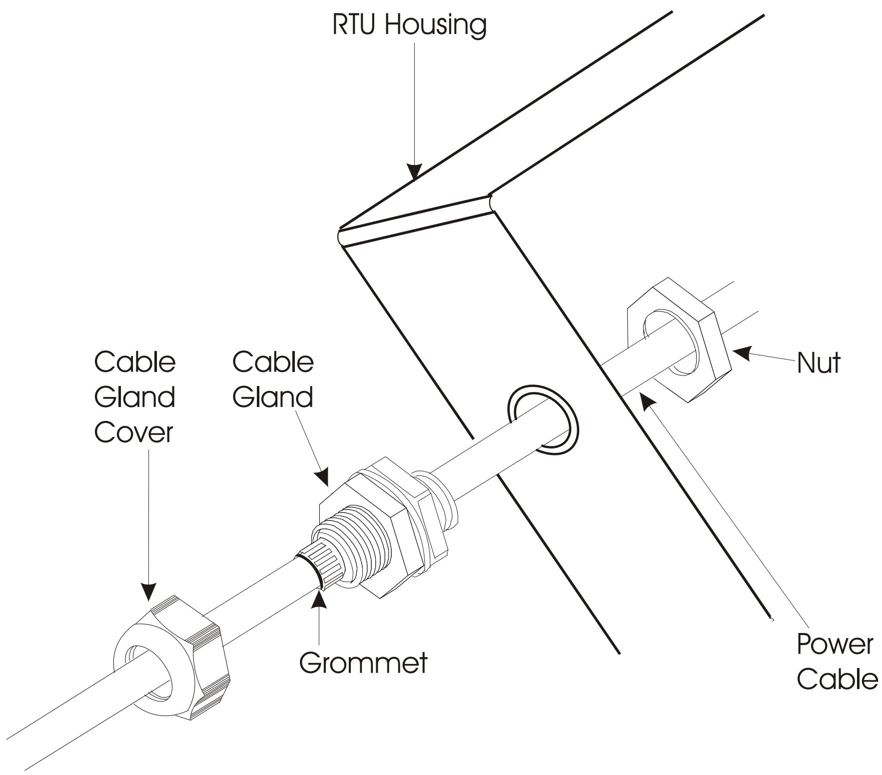


Figure 2-22 RTU in NEMA 4 Housing – Cable Gland Anchor Point 2

5) Attach the wires of the user cable, according to labels (~/0 for AC and +/- for DC.) See Figure 2-20 and Figure 2-21. For the No I/O frame, connect the ground cable to the lower wire terminals (third pair).

6) Tighten the screws of the wire terminals and screw the wire terminals onto the junction box.

7) Pass the power cable into the right side of the junction box, over the horizontal ridge.

8) Place the user cable into the clamp, close the clamp and screw it onto the junction box, into the hole next to wire terminals (anchor point #1).

9) Replace the junction box cover over the junction box.

10) Secure the junction box cover with the two saved screws.

11) For all installations except the No I/O frame, loosen two screws on the grounding strip at the bottom of the metal chassis/housing and connect the ground cable to the protective ground. Tighten the screws firmly.

12) Screw the top of the cable gland tightly to the cable gland to secure the cable (anchor point #2).

13) Open the door of the power supply module and release the cable holder (press downward).

14) Plug the connector of the power supply cable (FKN8381A/3089004V64 for DC, FKN8382A/3089004V65 for AC) into the cable inlet on the power supply module (on the bottom of the front panel.) and close the cable holder.

Connecting the Expansion Power Supply to the Main Frame Power Supply

When an I/O Expansion frame with an I/O Expansion power supply is added to the RTU, connect the power as follows:

Procedure 2-9 How to Connect the Expansion Power Supply to the Main Frame Power Supply

1) Using a DC power cable (FKN8559A/#3002360C26), connect the Rack Exp connector from the power supply on the main frame to the Power In connector on the Expansion power supply.

2) If the RTU includes more than one Expansion frame, use a DC power cable (FKN8559A/#3002360C26), to connect the Expansion Power Out connector on the preceding Expansion power supply to the Power In connector on the next Expansion power supply.

IMPORTANT

Before connecting I/O Expansion frames to the main frame, make sure that the power supplies in question meet the power requirements of the RTU. For information, see the ACE3600 System Planner.

Connecting the Backup Battery

The backup battery of ACE3600 is shipped from factory disconnected. Use this procedure to connect the battery cable to the power supply charger.

IMPORTANT

Before using the Lead Acid backup battery, it is strongly recommended to read the information on the battery provided in the Power Supply Module and Backup Battery chapter.

Lead acid batteries will self-discharge if they are stored without charging. Self-discharge below the manufacturer's recommended voltage will result in internal permanent damage to the battery rendering it inoperable. When this occurs, if connected to a power supply/charger, the battery may produce excessive internal heat and therefore deform and/or leak.

WARNING

A battery contains diluted sulfuric acid, a toxic and corrosive substance. Avoid any bodily contact with the leaking liquid when handling leaking batteries and affected parts. If the battery leaks and the liquid inside touch the skin or clothing, immediately wash it off with plenty of clean water. If the liquid splashes into eyes, immediately flush the eyes with plenty of clean water and consult a doctor. Sulfuric acid in the eyes may cause loss of eyesight and acid on the skin will cause burns.

Procedure 2-10 How to Connect the Backup Battery

1) Check the battery visually. If the battery looks deformed and / or you notice corrosion on the battery terminals and / or the battery leaks, DO NOT use the battery and replace it with a new battery.

2) Check the battery terminal voltage level before connecting it. If the battery voltage is less than 12.5V DC, DO NOT use the battery and replace it with a charged battery that measures at least 12.5V DC.

3) If the battery passes a visual inspection and the terminal voltage is correct, plug the battery cable (FKN8376A/#3089927V10) into the Battery In/Out connector on the power supply module.

4) Fully charge the battery prior to initial use (~10 hours).

Connecting I/O Modules to Ground

Before operating the I/Os in the ACE3600, the I/O modules must be connected to ground.

Procedure 2-11 How to Connect an I/O Module to Ground

1) Identify the PGND pin(s) on the I/O module using the Module Block Diagram or Connection Charts in the relevant chapter for the I/O module type. See the symbol next to the Protective Ground in the Module Block Diagrams.

2) If user-supplied cables are used, connect the ground wire(s) to the PGND pin(s) on the I/O module and to the grounding strip at the bottom of the RTU. (See grounding strip in Figure 2-19 above.)

3) If the wired cable braid is used, identify the ground wire(s) based on the pin number printed on the wire label.
Connect the ground wire(s) from the cable braid to the PGND pin(s) on the I/O module and to the grounding strip at the bottom of the RTU. (See grounding strip in Figure 2-19 above.)

4) Repeat steps 1-3 for the PGND wires on all I/O modules.

Connecting an RTU to Ground

When an RTU is installed, individual ground wires (from the power cable and from the PGND pin on the I/O module cables) are connected to the grounding strip on the chassis. The grounding strip must then be connected to the grounding point of the cabinet or 19" rack.

In an RTU with I/O expansion, the grounding strip of each frame must be connected to the grounding point of the cabinet or 19" rack. Figure 2-23 below depicts the ground connections of an RTU with a single expansion frame and Figure 2-24 depicts the ground connections of an RTU with multiple expansion frames.

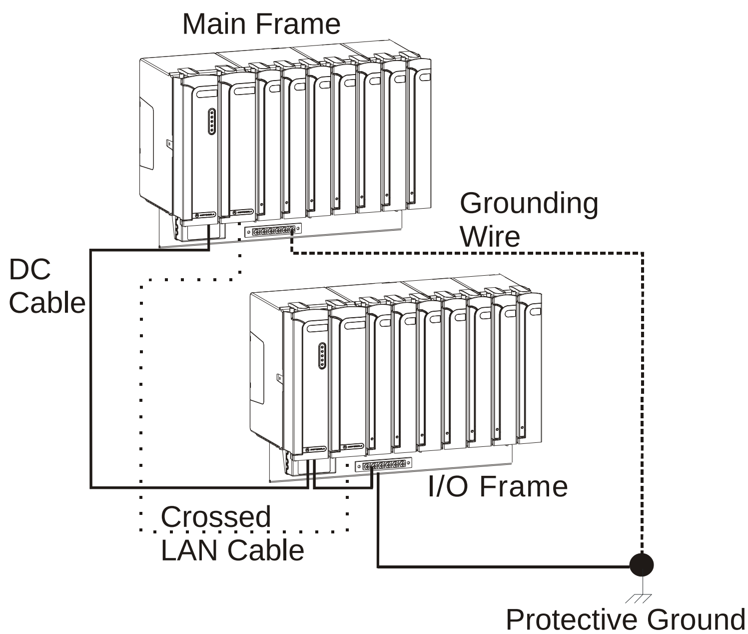


Figure 2-23 Ground Connections of an RTU with a Single Expansion Frame

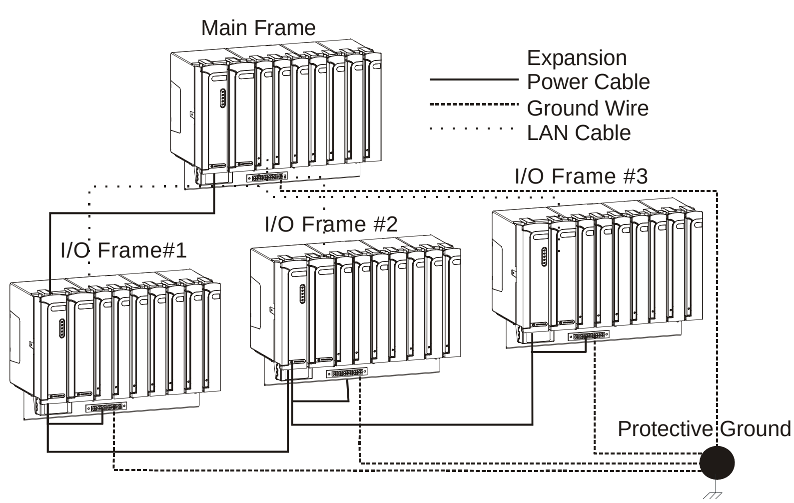


Figure 2-24 Ground Connections of an RTU with Multiple Expansion Frames

Connecting the Radio

A radio which is shipped in the ACE3600 is fully connected. To add a radio to the ACE3600, use the appropriate radio installation kit. For information on radio types, radio installation kits and connections, see the Radio Types and Installation Kits chapter.

Opening/Closing the Housing Door

The door to the small ACE3600 NEMA 4 housing is equipped with a latch or with an optional padlock accessory. See Figure 2-25. The door to the large ACE3600 NEMA 4 housing is equipped with two door latches or with an optional padlock accessory plus a latch. See Figure 2-26.

Procedure 2-12 How to Open and Close the Housing Door

1) To open a small RTU housing equipped with a door latch, turn the latch clockwise. The door will open.
   To open a small RTU housing equipped with the padlock accessory, remove the user-supplied padlock (if one exists) and turn the padlock accessory clockwise. The door will open.
   To open a large RTU housing equipped with two door latches, turn both latches clockwise. The door will open.
   To open a large RTU housing equipped with the padlock accessory and a latch, remove the user-supplied padlock (if one exists) and turn the padlock accessory and latch clockwise. The door will open.

2) To close a small RTU housing equipped with a door latch, turn the latch counterclockwise and push the door closed until the latch clicks.
   To close a small RTU housing equipped with the padlock accessory, turn the padlock accessory counterclockwise and push the door closed until the latch clicks. Add the user-supplied padlock (if one exists) to lock the door.
   To close a large RTU housing equipped with two door latches, turn both latches counterclockwise and push the door closed until the latch clicks.
   To close a large RTU housing equipped with the padlock accessory and a latch, turn the padlock accessory and latch counterclockwise and push the door closed until the latch clicks. Add the user-supplied padlock (if one exists) to the padlock accessory to lock the door.

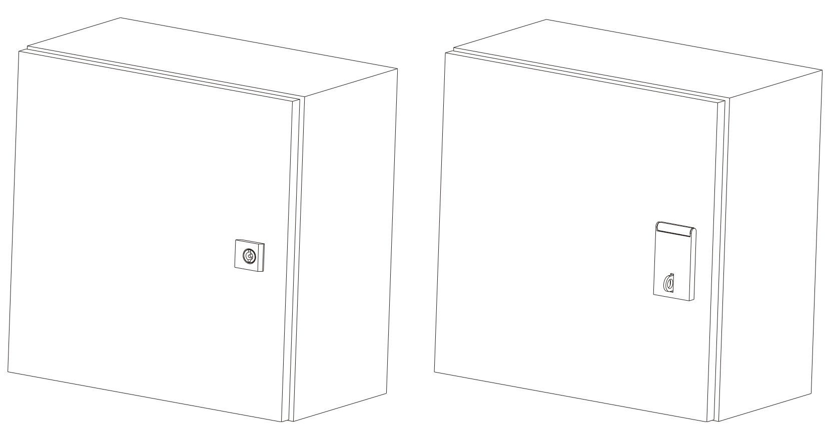


Figure 2-25 Small ACE3600 NEMA 4 Housing/Housing with Padlock

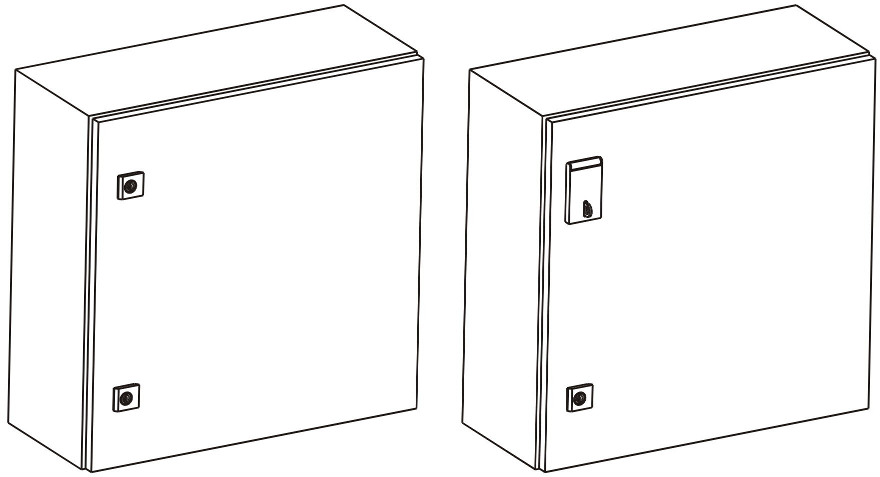


Figure 2-26 Large ACE3600 NEMA 4 Housing/Housing with Padlock

Installing Accessory Box Interfaces

Cards such as RS485 interface card can be attached to the ACE3600 RTU using a plastic accessory box. The accessory box can be attached to the 19" accessories metal chassis, small/large metal chassis, or small/large NEMA housing.

Procedure 2-13 How to Install the Accessory Box Interface on the Metal Chassis

1) To connect the accessory box interface to the metal chassis, place the box on the metal plate and click the two pegs on the back of the accessory box into the desired holes on the metal chassis. See Figure 2-27.
   Note: This figure is for illustration purposes only. It is not relevant to install all the accessories below on the same metal chassis.

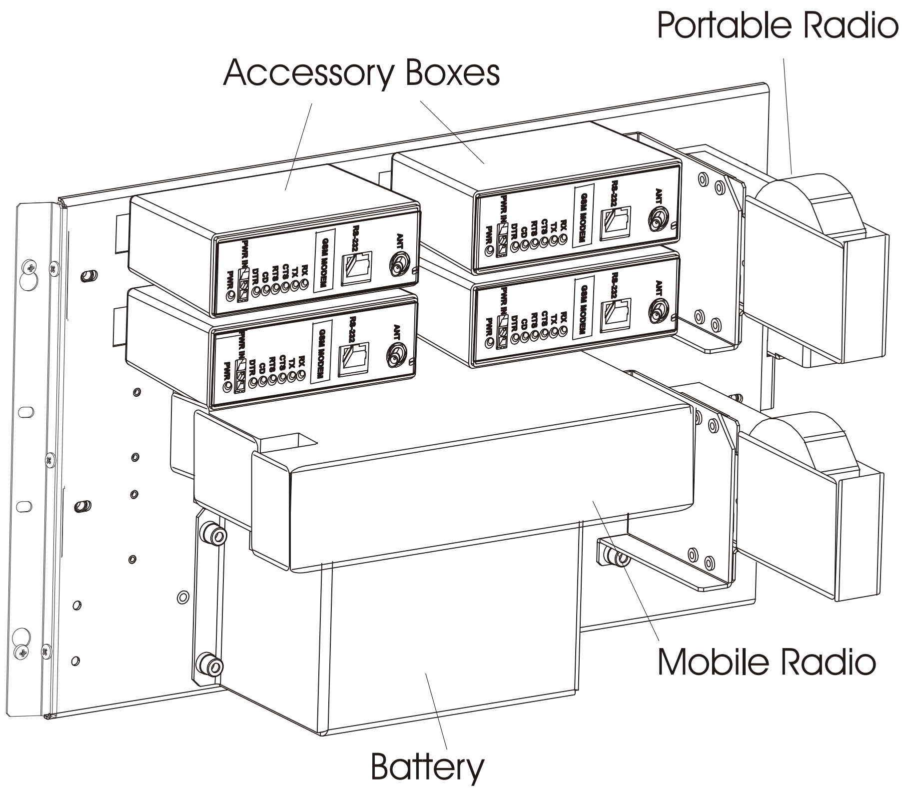


Figure 2-27 Accessories Installed on a Metal Chassis

2) To remove the accessory box interface from the metal chassis, insert a screwdriver into the notch located in the snap securing the unit to the chassis. Slightly bend the snap outwards to release it from the slot, and carefully pull out the unit.

19" Frame Metal Back Installation Combinations

The 19" frame metal back can be ordered with a variety of frames, modules, and accessories (e.g. battery, radio, accessory box.) In certain cases, choosing a certain accessory reduces the other options. For example, the portable radio is installed on the 19" frame metal back with the No I/O Frame in place of one accessory box. Likewise a battery is installed on the 19" frame metal back with the No I/O Frame in place of one accessory box.

For diagrams of the various combinations, see Figure 2-28 below.

Figure 2-28 19" Frame Metal Back Installation Combinations

POWER SUPPLY MODULE AND BACKUP BATTERY

General Description/Module Overview

The ACE3600 power supply module provides the other modules in the RTU with their operating voltages via the motherboard bus.

The following power supply options are available:

- DC power supply low-tier (10.8-16V)
- DC power supply (10.8-16V) - provided by default with the ACE3600 RTU
- DC power supply (18-72V)
- DC power supply (18-72V) with battery charger
- AC power supply- 100-240V
- AC power supply- 100-240V with battery charger

Common characteristics of all power supply modules (not including the DC power supply low-tier):

- On/Off switch on the front panel
- Controlled auxiliary voltage outputs
- Heat convection cooling (no need for fans)
- Short protection outputs
- Over heating protection
- Status LEDs in the front panel
- Power supply located on the leftmost slot of the frame, to the left of the CPU.
  In a frame with both redundant CPUs and redundant power supplies, the third slot from the left (between the primary CPU and the secondary CPU) is used by the redundant power supply.
- Input current protection fuse
- Controlled power line enables centralized disabling of Electrically Energized relay outputs in selectable DO modules.

Note: The DC power supply low-tier does not support radios that require input power other than 10.8-16V. Do not use portable radios which require 7.5V input with this option.

Note: The low limit of the DC power supply (10.8-16V) can be configured to 10.5V. The default is 10.8.

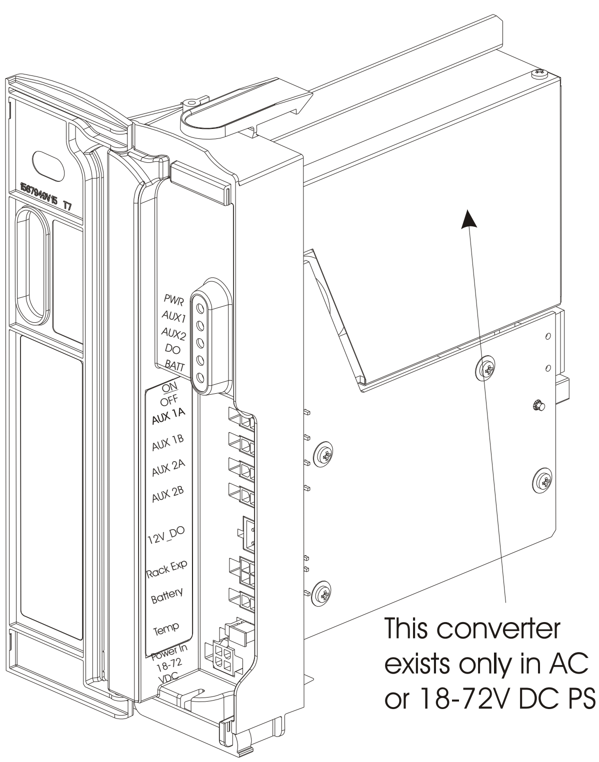
Common characteristics of power supply modules with battery charger:

- Automatic switchover to battery on power fail
- Automatic switchover to main power on power return
- Temperature compensated charging
- Over-charging protection
- Over-discharge protection
- Battery test and diagnostics, including battery controlled discharge

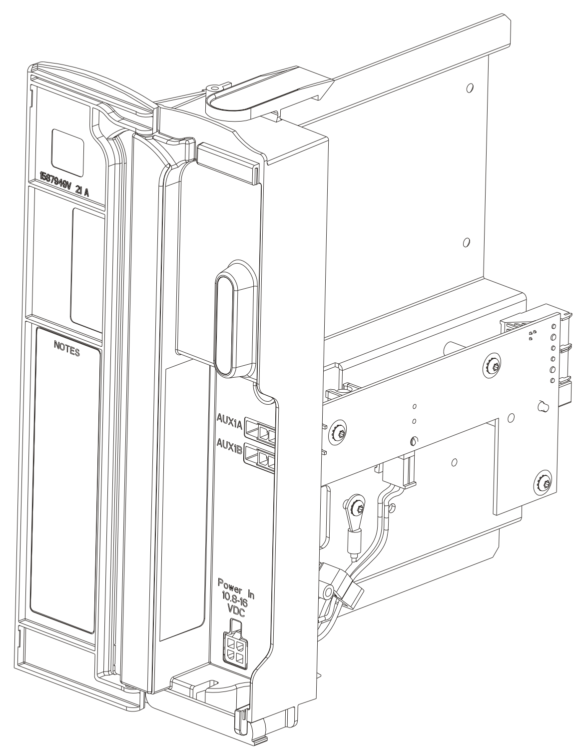
Characteristics of the DC power supply low-tier:

- Two auxiliary voltage outputs
- Short circuit protection outputs
- PS located on the leftmost slot of the frame
- Overvoltage protection for CPU and I/Os
- Reverse voltage protection

Figure 3-1 below depicts a general view of the power supply.



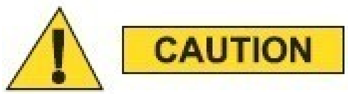
Power Supply



DC Power Supply Low-Tier

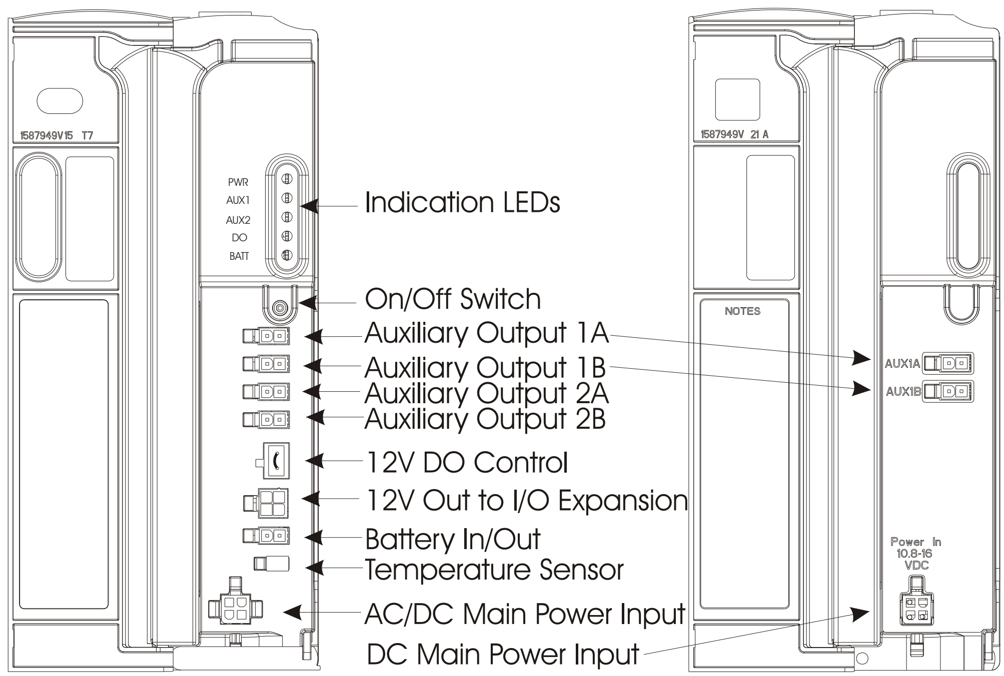
Figure 3-1 ACE3600 Power Supply – General View

Note: An additional power supply module for use with I/O expansion frames is described in the Expansion Power Supply Module chapter below.



METAL PARTS OF THE POWER SUPPLY MAY BE VERY HOT.
After removing the power supply module, allow the metal parts to cool down before servicing the unit.

Figure 3-2 below depicts a detailed view of the power supply front panel.



Power Supply **DC Power Supply Low-Tier**

Figure 3-2 ACE3600 Power Supply – Front Panel

ON/OFF Switch

The front panel of the power supply module includes an ON/OFF switch for the module. In the OFF (down) position, all the power outputs except Battery In/Out are disabled. A mechanism is provided to prevent accidentally changing the switch position.

NOTE

In power supply modules equipped with a battery charger, if the ON/OFF switch is in the OFF position, and the RTU main power is connected, the Battery In/Out is not disabled to ensure battery charging.

Input/Output Connectors

The front panel of the power supply module (not including DC power supply low-tier) includes the following connectors.

Connector Name	Description	Notes
Auxiliary Output 1A	13.8V DC (±5%) @ 20°C User controlled power output. Short protected.	This output is used for powering radios, modems, etc. The output can be switched ON/OFF either by the user application program or using the STS hardware test. (Default = ON) For more information, see the Performing Hardware Tests section or Application Programmer section of ACE3600 STS User Guide.
Auxiliary Output 1B	Same as Auxiliary Output 1A	Same as Auxiliary Output 1A
Caution: Auxiliary Output 1A and 1B are ON by default with 13.8V DC. Do NOT plug in a radio which requires less voltage or the radio may be damaged.		
Auxiliary Output 2A	DC Power Output Selectable/programmable 3.3 to 9V DC or 13.8V DC (±5%) @ 20°C. User controlled power output. Short protected.	This output is used for powering radios, modems, etc. The output voltage can be set by the user using the STS site configuration. The output can be switched ON/OFF either using the STS hardware test or by the user application program. (Default = OFF) If both 2A and 2B are ON, they must have the same output level. The voltage levels of AUX2A and AUX2B are the same.
Auxiliary Output 2B	Same as Auxiliary Output 2A	Note: Auxiliary Output 2B can be ON independently of 2A. The voltage levels of AUX2A and AUX2B are the same.

Connector Name	**Description**	**Notes**
Caution: If both 2A and 2B are ON, they must have the same output level. If cables are connected to Auxiliary Output 2A and 2B, they must use the same voltage.		
12V DO Control	Control input that enables centralized disabling of Electrically Energized (EE) relay outputs in selectable DO modules. Input open = Relays are disabled. (ML relays do not change state) Input shorted = Relays are enabled.	This input controls a dedicated 12V power line that is available to all the slots in the frame. In each relay DO module, the user can mechanically select to power the relay coils from this dedicated 12V power line. For details on setting this control, see the Module Configuration section of the DO Relay Module chapter. The power supplies on I/O expansion frames can be attached via DC cable to the power supply on the previous I/O expansion frame in a daisy-chain manner, or directly to the main power supply. In this case, the 12V DO control on the main power supply can control all DO EE relays in the entire RTU that were configured by dip switch for 12V DO. This enables the user to inhibit all DO EE relays in the entire RTU simply by removing the plug from the 12V DO control in the main power supply. If the main power supply does not control all other power supplies in the RTU, it is recommended to have a single on/off to control DO relays simultaneously.

Connector Name	Description	Notes
12V Out	In systems with I/O expansion, provides 12V output to expansion power supplies on expansion frames.	Pin 1- PGND Pin 2- 12V DO Pin 3- GND Pin 4- MAIN (12V) The power supplies on I/O expansion frames can be attached via DC cable to the power supply on the previous I/O expansion frame in a daisy-chain manner, or directly to the main power supply. In this case, the main power supply controls the entire RTU. This enables the user to turn off the entire RTU simply by turning off the main power supply. If the main power supply does not control all other power supplies in the RTU, it is recommended to have a single on/off switch to control all power supplies simultaneously.
Battery In/Out (only in power supply with charger)	Battery charger output when the main power exists. Backup power input from battery when the main power fails.	The charging voltage level is controlled by the battery charger and is a function of the temperature.
Temperature Sensor	Sensor for battery temperature to control charging level.	(In modules with power supply and charger only) For more information, see the Backup Battery section below.
AC/DC Main Power Input	Cable inlet for main power cable (AC or DC)	The cable is part of the RTU frame (connected to the power junction box.) Note: When the cable male connected is place in this input, it locks the power supply module in its slot. To remove the power supply module, first unplug the power input cable.

The front panel of the DC power supply low-tier includes the following connectors.

Connector Name	Description	Notes
Auxiliary Output 1A	Vin=Vout Shorted to Power IN.	This output is used for powering radios, modems, etc.

Connector Name	Description	Notes
Auxiliary Output 1B	Vin=Vout Shorted to Power IN.	This output is used for powering radios, modems, etc.
10.8-16V DC Main Power Input	Cable inlet for main power cable (DC)	The cable is part of the RTU frame (connected to the power junction box. Note: When the cable male connected is place in this input, it locks the power supply module in its slot. To remove the power supply module, first unplug the power input cable.

LEDs

The front panel of the power supply module (not including the DC power supply low-tier) includes five indication LEDs.

LED Name	Description	Status
PWR	Power LED	Indicates the existence of AC or DC main power in the Main Power input. When the ON/OFF switch is in ON position - the LED is lit in Green. When the ON/OFF switch is in OFF position, but there is AC or DC input or battery- the LED is lit in Red. When the ON/OFF switch is in ON position and the unit is powered from the battery - the LED is lit in Orange. When there is no AC or DC input or battery connected - the LED is OFF.
AUX1	Auxiliary Output 1 LED	AUX1A is ON - Green AUX1B is ON - Red AUX1A and AUX1B are ON – Orange
AUX2	Auxiliary Output 2 LED	AUX2A is ON - Green AUX2B is ON - Red AUX2A and AUX2B are ON – Orange
DO	Digital Output Control LED	Relays enabled – LED ON – Green Relays disabled – LED OFF

LED Name	Description	Status
BATT	Battery LED	No battery/thermistor - LED OFF Battery is fully charged (charging current <20mA) - LED ON - Green Battery is being charged (charging current >20mA and <600mA)- LED ON – Green/Yellow Blinking Battery is being charged (charging current >600mA)- LED ON – Yellow Battery is discharging (battery voltage is higher than voltage of power supply) - LED ON – Red. Battery charging current is stabilizing - LED ON – Yellow Blinking. When battery capacity test is being performed - the LED is lit in Green Blinking. Battery tests are performed using the STS Hardware Test function or the user application program.

Redundant Power Supply

Redundant power supplies are used to ensure a continuous supply of the required RTU voltages, in the event that one power supply fails. For details on the redundant power supply, see Appendix E: CPU and Power Supply Redundancy below.

Battery Charger

Power supply modules with a battery option support a 6.5 or 10 Ah Lead-Acid battery. The power supply automatically switches to the backup battery as a 12V DC power source for the RTU and communications when the main AC or DC power source fails.

Power supply modules with a 12 VDC smart battery charger option charge the backup battery when not in use, and protect the battery from over-discharge. The charger performs battery tests/diagnostics, including controlled battery discharge, when requested by the user. If the battery is failed, the charger will not charge it and will send a failed status signal to the CPU. If the battery is remotely located, long battery cables can be used.

The DC power supply low-tier does not include a battery option.

Charging the Battery

The charging voltage of the Lead-Acid battery is controlled by the charger as a function of the battery temperature. The charging profile is set to comply with the temperature-compensated float-voltage of the ACE3600 battery.

Diagnostics

A battery test can be performed on the Lead-Acid battery, either from the ACE3600 STS Hardware Test utility or from the user application program. The battery test includes disabling the battery charger, discharging the battery and measuring the capacitance. For more information, see the Hardware Test section or the Creating a User Application section of the ACE3600 STS User Guide.

NOTE

> It is recommended to run a battery capacity test once per month (for more exact results perform at +10˚ to +30˚C), and a charge level test once per day. The capacity test lowers the main DC to a safety net level (~12V) so that the battery will be activated. The battery is heavily loaded for ~45 seconds, the power supply LED blinks green, and the battery capacity is measured. If the capacity is below the manufacturer recommended level, the battery should be replaced with a new one. (See Replacing the Backup Battery below.) Note that the capacity test is only available for the battery types supplied by Motorola.

The results of the battery capacity test can be:

- Battery OK
- Battery needs to be replaced
- Test blocked - bad environment

The battery capacity test will be blocked under the following conditions:

1. If the battery is discharging (battery is main power source of RTU),
2. If the battery or thermistor is disconnected,
3. If the battery temperature is outside the specified range,
4. If the battery type is not properly configured,
5. If the battery is not fully loaded.

For test accuracy, all heavy current consumers should be turned off. In the Hardware Test, the user should freeze the power supply before performing the battery capacity test.

Connecting the Power Supply to a Power Source

The power supply can be connected to an AC or DC power source. The DC power supply low-tier can be connected to a DC power source only.

The expansion power supply module is connected to another ACE36000 power supply using a DC power cable (FKN8559A/#3002360C26).

For instructions on connecting the power supply to a power source, see the Power and Ground Connections section of the Installation chapter above.

IMPORTANT

All power and ground connections must be in accordance with local standards and laws.

Power Supply Module Specifications

The following charts detail the specifications of the various power supply modules. For specifications of the power supply module used with I/O expansion frames, see the Expansion Power Supply Module chapter below.

12V DC Power Supply Module (Default)	
Input Voltage	DC 10.8-16 V The low limit of the DC power supply (10.8-16V) can be configured to 10.5V. The default is 10.8.
Outputs	Motherboard connector (to CPU and I/O modules): equal to input voltage, max. 4 A AUX1A/AUX1B: equal to input voltage, max. 8 A, on/off controlled by user program AUX2A/AUX2B (configurable): equal to input voltage (default), max. 8A, or 3.3, 5, 7.5, 9 V DC ±10%, max. 2.5A, on/off (default) controlled by user program Note: max. 8 A total current consumption from all outputs
No Load Power Consumption	Max. 50 mA
Diagnostic LEDs	Status LED for: input voltage, AUX1 and AUX2 outputs, 12V control for DO modules
Input Protection	Internal line fuse, replaceable
Output Protection	AUX2A/B short circuit, automatic recovery on 3.3, 5, 7.5, 9 V
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 0.43Kg (0.95 Lb)

12V DC Low-Tier Power Supply Module	
Input voltage	10.8-16 V DC
Outputs	Motherboard connector (to CPU and I/O modules): The same as input voltage / max. 4 A AUX1A/AUX1B: equal to input voltage max. 8A Note: max. 8 A total current consumption from all outputs
Input Protection	Internal line fuse, replaceable
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 0.43Kg (0.95 Lb)

Specifications subject to change without notice.

18-72V DC Power Supply Modules	
Input Voltage	18-72 V DC
Total Power	18-72 V DC Max. 60 W continuous; max. 105 W peak @ 25% duty cycle
Outputs	Motherboard connector (to CPU and I/O modules): 13.2 V DC ±20%, max. 4 A AUX1A/AUX1B: 13.2 V DC ±20%, max. 8 A, on/off controlled by user program AUX2A/AUX2B (configurable): equal to AUX1A/AUX1B voltage, max. 8 A, or 3.3, 5, 7.5, 9 V DC ±10%, max. 2.5A, on/off (default) controlled by user program Note: max. 8 A total current consumption from all outputs
Battery Charger	12 V Lead Acid battery charger (in PS model with charger) Automatic charging of 6.5 or 10 Ah backup battery, battery temperature sensing, overcharging protection, battery capacity test and diagnostics, automatic battery switch-over
Diagnostic LEDs	Status LED for: input voltage, AUX1 and AUX2 outputs, 12 V Control DO for DO modules, and battery
No Load Power Consumption	Max. 250 mA
Efficiency	80% typical, 76% with full load
Inrush Current	10 A maximum, for 2 mSec. Max, cold start at 25°C
Protection	Internal line input fuse (replaceable), short circuit automatic recover
Output Protection	AUX2A/B short circuit, automatic recovery on 3.3, 5, 7.5, 9 V
Insulation	Input to case: 500 V DC, input to output 500 V DC
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 1Kg (2.2 Lb)

Specifications subject to change without notice.

AC Power Supply Module	
Input voltage	100-240 V AC, 50/60 Hz 100-240 V AC, 50/60 Hz with 12V smart battery charger
Total Power	Maximum 60 W continuous; maximum 105 W peak @ 25% duty cycle
Outputs	Motherboard connector (to CPU and I/O modules): 13.2 V DC ±20%, max. 4 A AUX1A/AUX1B: 13.2 V DC ±20%, max. 8 A, on/off controlled by user program AUX2A/AUX2B (configurable): equal to AUX1A/AUX1B voltage, max. 8 A, or 3.3, 5, 7.5, 9 V DC ±10%, max. 2.5A, on/off (default) controlled by user program Note: max. 8 A total current consumption from all outputs
Battery Charger	12 V Lead Acid battery charger (in PS with charger) Automatic charging of 6.5 or 10 Ah backup battery, battery temperature sensing, overcharging protection, battery capacity test and diagnostics, automatic battery switch-over
Diagnostic LEDs	Status LED for: input voltage, AUX1 and AUX2 outputs, 12V Control for DO modules, and battery
No Load Power Consumption	130 mA @ 220 V AC
Efficiency	80% typical @230 V AC, 76% typical @115 V AC (full load)
Inrush Current	25 A maximum, for 2 mSec. Max, cold start at 25°C
Power Factor	0.98 typical at 230 V AC, 0.99 typical at 115 V AC
Protection	Internal line fuse, replaceable
Output Protection	AUX2A/B short circuit, automatic recovery on 3.3, 5, 7.5, 9 V
Insulation	Input to case: 1500 V AC, input to output: 3000 V AC
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 1kg (2.2 lb)

Specifications subject to change without notice.

Backup Battery

Overview

The ACE3600 backup 12V Lead-Acid battery provides backup for the main input power. The battery is available in two capacities: 6.5 Ah and 10 Ah. Switching from main input power to the battery and charging of the battery is performed by the ACE3600 power supply module.

Sealed Lead Acid technology batteries can be recharged and discharged at a temperature range of -30º to +60ºC. Storage and operating temperatures affect the battery capacity and lifespan. ACE3600 power supply modules include a special charging power supply designed to fit the specific temperature-compensated float-voltage-charging curve of the battery.

CAUTION

Lead Acid batteries will self-discharge if they are stored without charging. Self-discharge below the manufacturer's recommended voltage will result in internal permanent damage to the battery rendering it inoperable. When this occurs, if connected to a power supply/charger, the battery may produce excessive internal heat and therefore deform and / or leak.

The batteries are shipped disconnected from the power supply/charger. To ensure that there are no battery problems on your ACE3600 project, each Lead Acid battery MUST be fully charged and checked before connecting it to the ACE3600 power supply/charger. To verify that the battery is fit for use, measure the BATTERY OPEN CIRCUIT voltage (when the battery is not connected to the power supply/charger) with a digital voltmeter. If the battery voltage is less than 12.5 V DC, DO NOT use the battery and replace it with a new ACE3600 battery that measures more than 12.5 V DC.

Before transporting the battery, read and follow all safety information located on the battery case.

IMPORTANT

ACE3600 batteries are shipped from the factory tested, fully charged and with a label stating the next time it should be recharged when stored at temperatures of 30ºC or less.

Motorola battery warranty is valid only when the battery is charged with the original Motorola ACE3600 charging power supplies. Use of any other power supply/charger will void the battery warranty.

Under various state or local laws, the batteries must be recycled or disposed of properly and cannot be disposed of in landfills or incinerators. Environmental protection regulations classify used Lead Acid batteries as hazardous waste, unless certain exemptions apply. Consideration should be given to the methods of collecting, labeling, handling and shipping used Lead Acid batteries. Please consult the environmental protection authority for specific legal requirements and for recycling options in your country/area.

Backup Battery Storage, Lifespan, Inspection and Replacement

The manufacturer's recommendations for handling during each of the battery's life stages are:

- Transportation:

  Batteries must be handled with care to prevent falls, impact, short circuit or exposure to high temperatures and fire.

- Battery Storage:

  Storage of batteries in a warehouse requires a periodic recharge. The time between these recharge cycles depends upon the storage temperature. The minimum open circuit voltage allowed on the battery before recharging is 12.42 V, which represents remaining capacity of approximately 30%. Therefore it is recommended to perform a full charging cycle every few months depending upon the storage temperature of the battery. Please refer to Table 3-1 to determine the suggested maximal period between recharge cycles that suits the actual storage conditions. Improper storage may cause deep discharge of the battery, which might cause degradation of the battery operating life and lower the actual delivered capacity. Motorola performs a periodic full charge cycle procedure on stored batteries and a final full charge operation prior to shipment.

- Lifespan:

  The average temperature of the battery environment affects the lifespan of batteries installed in the field. Please refer to the battery vendor information at the following website:

  · (Sonnenschein A512/6.5S and A512/10S): http://www.sonnenschein.org/A500.htm

- Inspection and Replacement:

  It is important to inspect the batteries periodically (recommended every 6-12 month) and replace any battery that has corrosion on the leads or it is deformed or leaks. Such a battery should be disposed according to the local environmental laws. To assure the battery availability and proper operation, the battery should be replaced at the end of its lifespan (approximately 30% capacity) even if it is still functional. Measure the battery open circuit voltage using a digital voltmeter as described above. Please note that using a battery beyond its lifespan period may cause a battery heating, leakage and/or deformation.

Table 3-1: Recommended Time between Periodic Battery Recharge vs. Storage Temperature

Average Storage Temp (°C)	Recharge Interval (Months)
25	12
45	4
60	1

Replacing the Backup Battery

WARNING

A battery contains diluted sulfuric acid, a toxic and corrosive substance. Avoid any bodily contact with the leaking liquid when handling leaking batteries and affected parts. If the battery leaks and the liquid inside touch the skin or clothing, immediately wash it off with plenty of clean water. If the liquid splashes into eyes, immediately flush the eyes with plenty of clean water and consult a doctor. Sulfuric acid in the eyes may cause loss of eyesight and acid on the skin will cause burns.

Procedure 3-1 How to Replace the Lead Acid Backup Battery

To replace the Lead-Acid backup battery, follow the procedure below.

1) Disconnect the battery cable from the Battery connector of the power supply (see Figure 3-2) and from the battery.

2) Unscrew the battery holders (two screws in the small battery and four screws in the large battery) with the attached battery temperature sensor. (See Figure 3-3 below.)

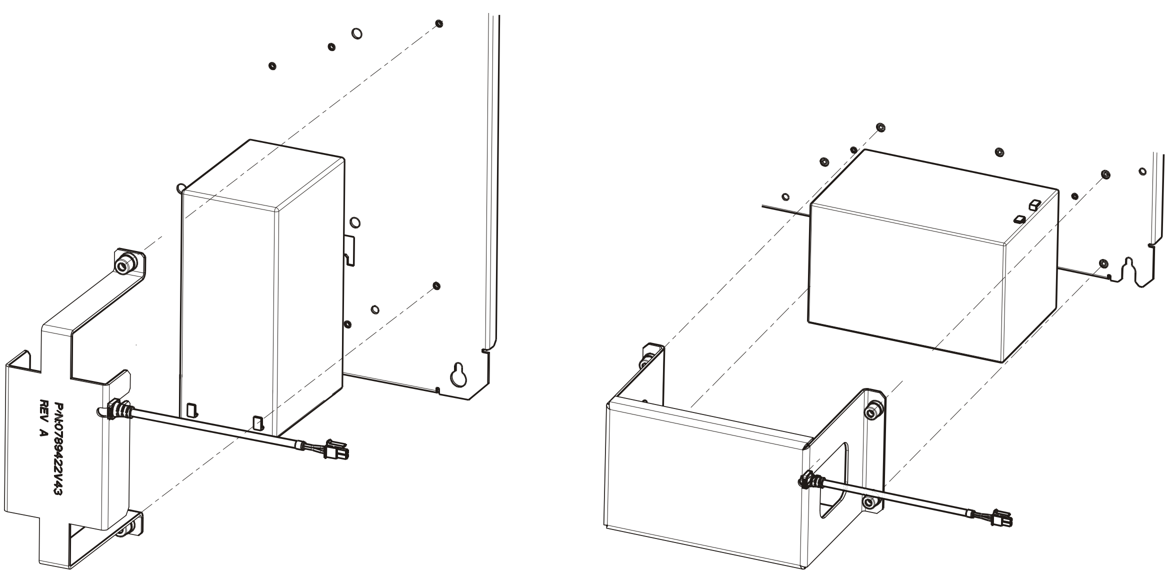


Figure 3-3 Backup Batteries – Exploded View

3) Remove the old battery from the RTU.

4) Check the replacement battery visually. If the battery looks deformed, if you notice corrosion on the battery terminals, or the battery leaks, DO NOT use the replacement battery; get another replacement battery.

5) Check the replacement battery terminal voltage level before connecting it. If the battery voltage is less than 12.42V DC, DO NOT use the battery and replace it.

6) If the replacement battery passed the visual inspection and the terminal voltage is satisfactory, put the battery into place on the RTU and screw in the battery holders.

7) Connect the battery cable to the battery terminals in the correct polarity.

8) Connect the battery cable to the Battery In/Out connector on the front panel of the power supply module.

9) Recharge the replacement battery for 10 hours to be fully charged.

CPU MODULE

General Description

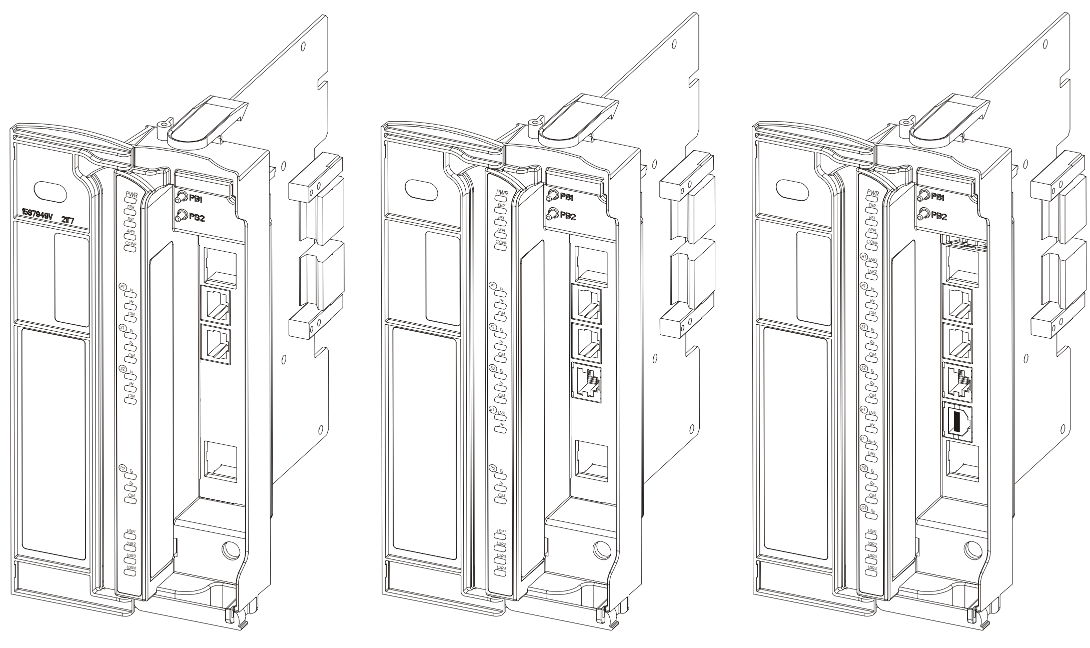
The main element of the ACE3600 is the CPU module. It controls the I/O modules, processes the gathered data and communicates with the outside world.

The core of the module is Freescale's MPC8270 32-bit microprocessor which has extended communication capabilities, high speed core, DMA and floating point calculation support. The module includes on-board memory, communication ports, I/O bus interface and other circuits. The firmware is based on Wind River's VxWorks operating system.

Module Location: The CPU is a removable module located in a dedicated slot in the RTU rack. The CPU module must be plugged into the wide slot to the right of the Power Supply module. (Inserting the module in the wrong slot will not cause any damage to the CPU.)

For information on the location and arrangement of CPUs in the redundant CPU and power supply frame, see Appendix E: CPU and Power Supply Redundancy below.)

Figure 4-1 provides a general view of the ACE3600 CPU (Models 3610*, 3640, and 3680).



Model 3610 **Model 3640** **Model 3680**

Figure 4-1 ACE3600 CPU – General View

* The CPU 3610 model has been discontinued.

The CPU panel includes status LEDs, user LEDs, communication port LEDs, two pushbuttons, and communication ports. The panel is covered by the module door.

Figure 4-2 provides a detailed view of the CPU front panel.

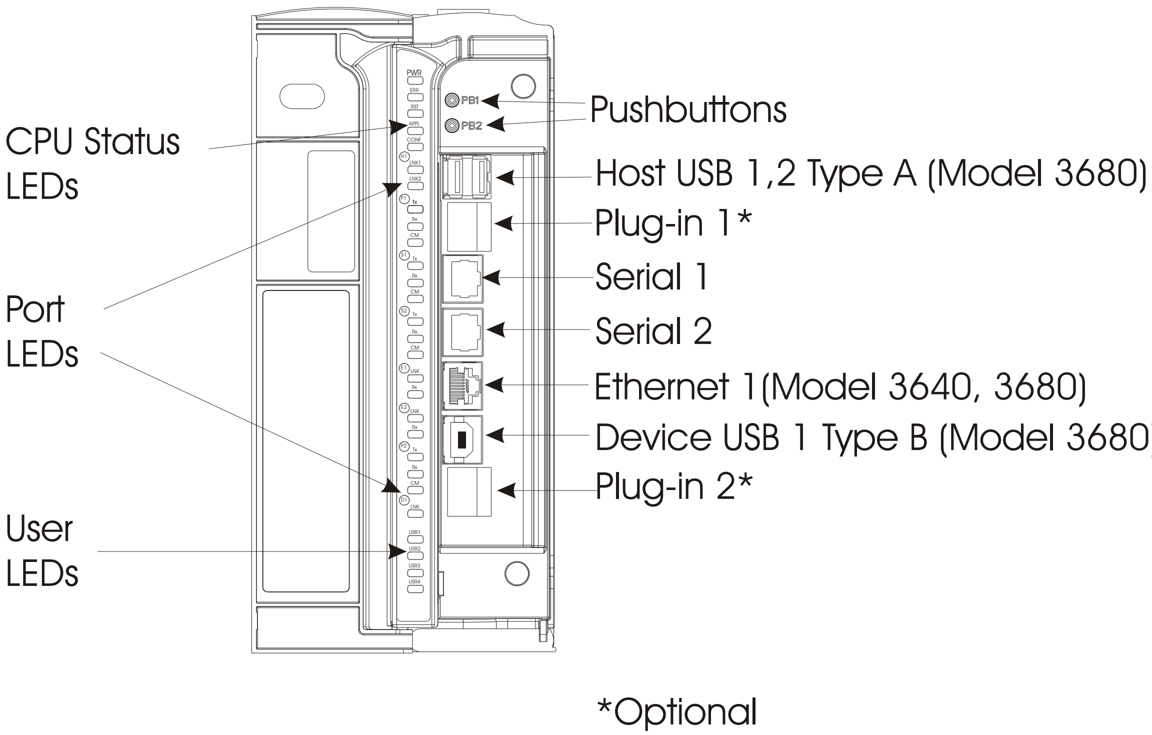


Figure 4-2 ACE3600 CPU (Models 3610/3640/3680) – Front Panel

Front Panel

Communication Ports

The CPU module includes several communication ports:

<u>On Board ports:</u>

- USB Host 1/2 (HU1/HU2) - USB Type A host full speed ports for MDLC over IP communication via the MotoTrbo digital mode radio system (up to two radios attached to two USB host ports at one time) No USB devices or USB Hubs other than MotoTrbo radios are supported.
- Serial 1 (SI1) – RS232/RS485 serial port (configurable)
- Serial 2 (SI2) – RS232 serial port
- Ethernet (Eth1) - 10/100BaseT Ethernet port (CPU 3640 or 3680 only)
- DU1 – USB device port, Type B connector (future option)

- Internal Ethernet port (Int 1) – Internal 100 Mb Ethernet port, (for communication between dual redundant CPUs) (CPU 3680 only)

Plug-in port bays, where different types of ports can be installed:

- Plug-in 1 (PI1) – fits RS232, RS485, 10 MB Ethernet, 10/100 MB Ethernet, or Radio Modem Plug-in option
- Plug-in 2 (PI2) – fits RS232, RS485, 10 MB Ethernet, or Radio Modem Plug-in port option.

For the detailed specifications of each port, see CPU 3610/CPU 3640 Module Specifications and CPU 3680 Module Specifications below. For information on the cables and connectors, see Appendix C.

NOTE

The ACE3600 Ethernet port performs an Auto-Negotiation procedure whenever a peer device connection is detected at a 10/100 Mbps Ethernet port.. The Auto-Negotiation procedure guarantees that the speeds of ACE3600 and peer Ethernet ports will match, whether or not the peer supports Auto-Negotiation. If the peer supports Auto-Negotiation, the duplex of ACE3600 and the peer Ethernet ports also match.

It is recommended to configure the Ethernet port of the device connected to the ACE3600 Ethernet port (e.g. switch, etc.) to Auto-Negotiation mode. This will guarantee a full match of speed and duplex between the ACE3600 and the peer device Ethernet ports. If the peer device Ethernet port does not support Auto-Negotiation, set the duplex of the peer to half duplex to avoid the duplex mismatch problem.

	Peer Ethernet Port Mode				
	Auto	**100 Mbs Full Duplex**	**100 Mbs Half Duplex**	**10 Mbs Full Duplex**	**10 Mbs Half Duplex**
Speed Match with ACE3600	✔	✔	✔	✔	✔
Duplex Match with ACE3600	✔	✘	✔	✘	✔

Buzzer

The CPU module includes a buzzer (audio indication), which is used to indicate task completion (such as end of download/upload, restart etc.) and can also be controlled from the user application program.

Pushbuttons

The CPU includes two pushbuttons on the front panel, PB1 and PB2.

These pushbuttons are used for activating and testing the modules LED, restarting the unit, erasing the user Flash memory and activating memory test. Table 4-2 describes the pushbuttons functionality.

The pushbuttons can also be monitored by the user application program (when it is running) for the application purposes.

LEDs

The CPU includes CPU status LEDs, port status LEDs, and user LEDs. Some of the LEDs are single color (green) and some are bicolor LEDs (red, green or orange).

Status LEDS indicate the CPU status in startup (boot), run-time or when there is a failure. The communication LEDs are used to indicate the communication port status. The user LEDs can be used by the user application program. Note that during startup or failure, the communication and user LEDs are used to indicate various situations. Table 4-4 details the LEDs functionality.

CPU Memory

The ACE3600 CPU includes Flash, SDRAM, and optional SRAM Plug-in memory.

The Flash stores the firmware, the user application program, and the user data.

The SDRAM memory stores the temporary data.

The optional SRAM memory expansion is used for logging user data. The SRAM data is retained using an on-board rechargeable lithium battery. See Backup Battery for SRAM and RTC for more information.

The size of the CPU memory is determined by the model as shown in the table below.

Table 4-1 ACE3600 CPU Memory

	Model 3640	Model 3680	Model 3610*(discontinued)
Flash memory	16 MB	32 MB	16 Mb
SDRAM memory:	32 MB	128 MB	32 Mb
User Flash:	3 MB	19 MB	3 Mb
User SDRAM:	10 MB	100 MB	10 Mb
SRAM Plug-In	4 MB	4 MB	4 Mb

Real Time Clock (RTC)

The CPU includes a low drift RTC. The date and time are retained using an on-board rechargeable lithium battery.

The CPU date and time can be set using the ACE3600 STS. The CPU can also be synchronized with other RTUs in the system, using the system clock. For more information, see the Setting/Getting a Site's Date and Time section or the Creating a User Application section of the ACE3600 STS User Guide.

Backup Battery for SRAM and RTC

The CPU module includes a rechargeable lithium battery that provides backup power and data retention for the SRAM and RTC.

The lithium battery is located on the CPU board and cannot be replaced.

Typically, the battery will retain the SRAM data and RTC for 60 continuous days without power and no Lead-Acid backup battery. When the SRAM option is not used, the Lithium battery will keep the Real Time Clock running for a longer period of time.

Redundant CPU

CPU redundancy (ACE3680 only) ensures continuous RTU operation if one CPU fails. For details on the redundant CPU, see Appendix E: CPU and Power Supply Redundancy below.

CPU Firmware and Operation Modes

The CPU firmware is a real-time multitasking operating system, based on the Wind River VxWorks OS. The CPU shipped from the factory with the most recent firmware version, and it can be updated/replaced using a remote or local connection. Downloading firmware updates is performed using the STS. (See Downloading to a Site in the ACE3600 STS manual.) If the new firmware download stops or fails, the CPU will restart with the existing firmware.

Power-up and Restart

The CPU requires DC voltage provided by the power supply module via the motherboard (when the PS switch is ON). The CPU will power-up and restart in the range of 10.8V to 16V DC. During power-up, the processor performs fast memory tests, initiates the RTU and starts the user program (if one was downloaded). The end of the power-up sequence is indicated by the buzzer. The length of time from the beginning of CPU power-up until the user program starts running is approximately 10-15 seconds.

It is possible to perform a comprehensive memory test during power-up by pressing push-button PB1 for few seconds while switching the power supply from OFF to ON. In this case the power-up period is about 30-35 seconds long.

If the startup fails, the RTU will freeze (boot sequence stops), the PWR LED will blink and the four indicator LEDs (see LEDs Location in Table 4-3) will blink seven times. The four LEDs will then display the failure error in binary code, as described in Table 4-3.

Restart after Firmware Download

The RTU will restart after downloading system firmware. If the firmware is faulty or the firmware download failed, the RTU, if protected by the Safe Firmware Download feature, will restart and roll back to the previous firmware version. A failure message will appear in the STS Downloader screen. For information on using the Safe Firmware Download feature, see the Safe Firmware Download section of the ACE3600 STS Advanced Features manual.

Restart after Configuration Download

The RTU will restart after downloading a site configuration. For information on downloading to the RTU, see the Operation chapter of the ACE3600 STS User Guide.

If the RTU fails to restart after the user-defined site configuration was downloaded, a unique LED display (in the range of the PI1-TX and SI2-RX LEDs) and a series of buzzer tones will follow. The RST LED will turn RED and the RTU will restart itself with the previous “good” configuration. The following message will appear in the RTU Error Logger “Configuration file was deleted due to failure in startup. Rolling back to the last configuration file”. Errors can be retrieved from the RTU using the ACE3600 STS Error Logger utility.

If the startup succeeds after configuration download but has errors, these errors are reported in the RTU Error Logger. It is, therefore, recommended to check for errors after downloading a configuration file to the RTU. Errors can be retrieved from the RTU using the ACE3600 STS Error Logger utility.

For information on retrieving errors from the RTU Error Logger, see the Operation chapter of the ACE3600 STS User Guide.

Restart after Erase Flash

After the User Flash is erased, the RTU will restart successfully with the default site configuration.

Power-down

When the voltage provided to the CPU module drops below the minimum level, the CPU will shut down in an orderly fashion. This level is configurable for all power supply modules other than the 12V DC power supply low-tier. See the ‘Minimum DC operation voltage’ parameter in Appendix A: Site Configuration Parameters of the ACE3600 STS User Guide.

CPU Status and Diagnostics

The CPU status is indicated on the front panel LED. Detailed CPU status and diagnostics information can be retrieved from the module using the CPU Hardware Test utility. For more details, see the Hardware Test section of the ACE3600 STS User Guide.

CPU Warnings and Errors

CPU warnings and errors are logged in the CPU memory to indicate issues or errors during power-up, restart, user application program execution and other modes of CPU operation. The existence of CPU warnings and errors are indicated in the ERR LED on the front panel of the module. Green indicates a message, orange indicates a warning and red indicates an error.

The CPU error logger information can be retrieved using the STS Error Logger utility. For more details, see the Error Logger section of the ACE3600 STS User Guide.

CPU Serial Number

Each CPU has a unique serial number. This number is printed on a label on the side of the CPU module front panel. The serial number can be read using the STS Hardware. For more information, see the Hardware Test section of the ACE3600 STS User Guide.

Connecting Plug-In Ports to the CPU Module

In general, the plug-in ports are ordered as options with the RTU and are installed in the factory. However, it is also possible to add plug-in ports to the CPU after it is shipped from the factory. Several plug-in ports are available. See Communication Ports above.

Note: A TORX screwdriver is required for installation of the plug-in ports.

Figure 4-3 depicts a plug-in port board attached to the ACE3600 CPU module.

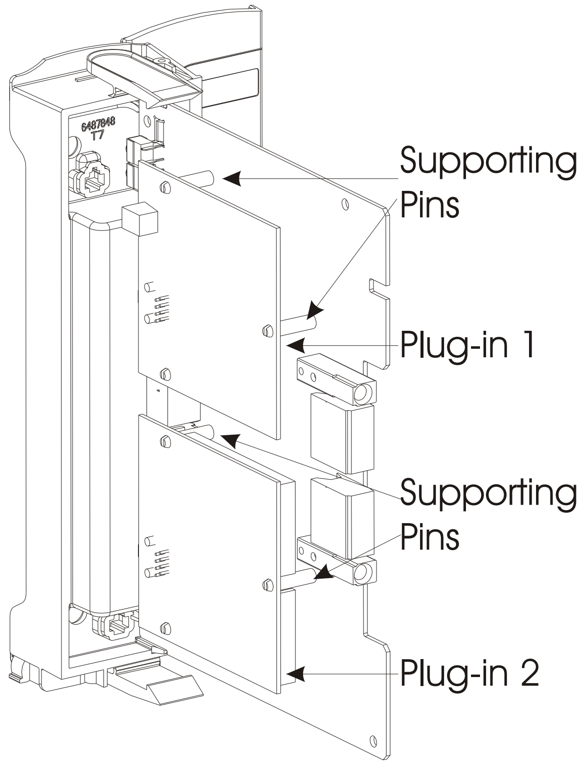


Figure 4-3 Plug-In Port in CPU Module

Procedure 4-1 describes how to connect a plug-in port to the CPU.

Procedure 4-1 How to Connect a Plug-in Port to the CPU

1) Remove the CPU module from the RTU.

2) Remove the cover from the desired opening on the front panel.

3) Connect two supporting pins with screws to the plug-in port.

4) Place the plug-in board with the RJ-45 connector facing the panel. Carefully insert the plug-in board connector into the appropriate connector on the CPU board.
For <u>Ethernet 10/100 MB,</u> use the J14 connector on the CPU (Plug-in 1 only.)
For <u>all other plug-in ports,</u> use the J5 (Plug-in 1) or J6 (plug-in 2) connector.

5) Connect the two supporting pins with screws to the other side of the CPU board.

6) Replace the CPU module in the slot.

Connecting SRAM Expansion Memory to the CPU Module

In general the plug-in SRAM is ordered as an option with the RTU and is installed in the factory. However, it is also possible to add plug-in SRAM to the CPU after it is shipped from the factory.

Note: A TORX screwdriver is required for installation of the SRAM.

Figure 4-4 depicts the user SRAM Plug-in memory in the ACE3600 CPU module.

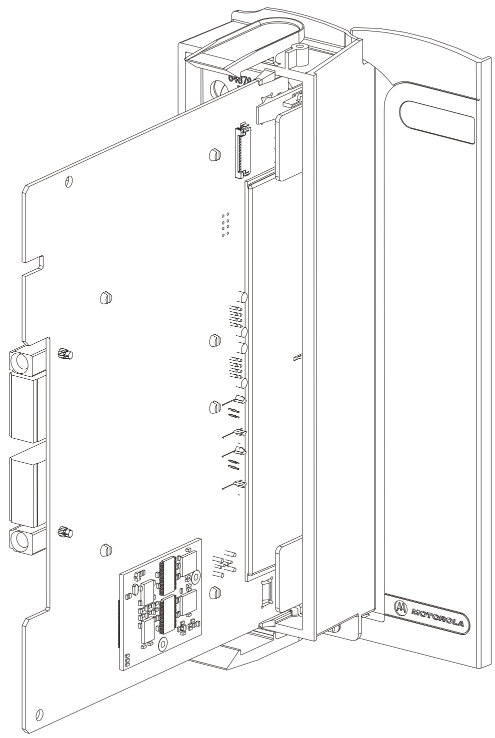


Figure 4-4 SRAM Expansion in CPU Module

Procedure 4-3 describes how to connect a plug-in SRAM memory card to the CPU.

Procedure 4-2 How to Connect a Plug-in SRAM Memory Card to the CPU

1) Remove the CPU module from the RTU.
2) Remove the cover from the connector marked P12 on the CPU board.
3) Place the plug-in SRAM memory card with the connector facing the panel. Carefully insert the plug-in board connector into the connector on the CPU board.
4) Secure the memory card to the CPU board with the supplied screw.
5) Replace the CPU module in the slot.

Pushbutton Functionality

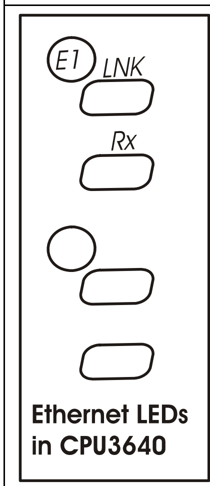
The table below describes the use of the two pushbuttons in various scenarios, during power-up and run-time. To press a pushbutton during startup, first press the pushbutton(s), then turn on the RTU using the On/Off switch on the front panel. Keep the pushbutton(s) depressed for the required number of seconds, as specified in the scenarios below.

Table 4-2 ACE3600 Pushbutton Functionality

Scenario	Trigger	Action
LEDs Test	During run-time, press PB1 for five or more consecutive seconds (but less than 30).	All the LEDS on the CPU and I/O modules will be lit until let go of PB1 and then returned to their previous states.
RTU Restart	During run-time, press PB1 for 30 consecutive seconds.	All the LEDs will be lit. Then all the LEDs will blink once. The buzzer will buzz several short beeps. (If PB1 is released during this time the restart will not be performed.) At the long beep, release PB1 and the RTU will restart (and the buzzer will buzz.)
Turn LEDs ON	During run-time, press PB1 for one second.	Those LEDs which are currently active will be turned on for a period of time (configured in the RTU configuration using the STS.)
RAM Test	During startup, press PB1.	A detailed memory test of SDRAM and SRAM plug-in is performed. - At the beginning of the RAM test, the four indicator LEDs (see LEDs Location in Table 4-3) will blink three times. During the RAM test, the LEDs may blink or be lit. If the RAM test succeeds, the four LEDs will blink three times and turn off and the restart sequence will continue. If the RAM test fails, the RTU will freeze (restart sequence stops), the PWR LED will blink and the four LEDs will blink seven times. The failure error code will then be displayed on the LEDs, in binary code, as described in Table 4-3. - To exit/abort the RAM test in the middle, restart the RTU using the On/Off switch on the front panel.

Scenario	Trigger	Action
Erase User Flash	During startup, press both PB1 and PB2 simultaneously until the buzzer buzzes five times quickly, then continuously for three seconds.	All the user Flash memory content excluding logging files (files tagged as data logging files) is erased, including the site configuration, user application programs, user tables, etc.
Bootstrap	During startup, press PB2 continuously for five seconds. Note: Before initiating bootstrap, the CPU must be connected directly to the STS PC in standalone mode. No other components can be on the network which might create a conflict with the default IP address.	The RTU will start up in diagnostic mode. Communication with the RTU is for diagnostic purposes only (Error Logger/ SW Diagnostics.) You cannot download to the RTU and no application will run. If the bootstrap fails, the four indicator LEDs (see LEDs Location in Table 4-3) will display the failure error in binary code, as described in Table 4-3.

Table 4-3 ACE3600 Failure – Error Code Display on LEDs

LEDs Location	LED Error Code	Description
 On CPU 3640/3680, the four LEDs begin with the group marked E1, as above.	ERR Code 1 OFF OFF OFF ON ERR Code 2 OFF OFF ON OFF ERR Code 3 OFF OFF ON ON ERR Code 4 OFF ON OFF OFF ERR Code 6 OFF ON ON OFF	ERR Code 1 = Error in Flash ERR Code 2 = Error in SDRAM ERR Code 3 = Error in SRAM ERR Code 4 = Unable to boot. Corrupted bootstrap. ERR Code 6 = Low voltage under 12V Where OFF LED = ‘0’; ON LED = ‘1’ (very fast blink, almost continuous); The highest LED is the most significant.

CPU LEDs Behavior

The table below describes the behavior of the LEDs on the CPU module.

Table 4-4 ACE3600 CPU LEDs Behavior

LED Name	Description	Status
PWR	Power LED Bicolor LED (Red, Green)	Flashing Red – Power exists; CPU FPGA not loaded. Green – Power exists; CPU is running from a recognized power supply (one of the six power supply options.) Red – Failure on power-up. CPU is running from an unrecognized power supply.
ERR	Error Logger Status LED Bicolor LED (Red, Green)	OFF – No new errors or warnings. Green – New message logged. Orange – New warning logged. Red – New error logged. Note: In systems with I/O expansion, the ERR LED can indicate an error in either the main or expansion frame.
RST	Reset LED Bicolor LED (Red, Green)	Green – On startup OFF – Successful power-up or restart. Red – Power-up or restart failed.
APPL	Application LED Bicolor LED (Red, Green)	OFF – No user application program in the Flash memory. Green – User application program is running. Orange – User application program was paused by user (during Hardware Test.)
CONF	Configuration LED Bicolor LED (Red, Green)	OFF – Configuration was not loaded. Green – Configuration was loaded. Red – Configuration error.
H1 LNK1*	USB Host1 LNK (link) Green LED	ON – A USB device is connected. OFF – No link exists between the CPU and the MotoTrbo radio.

* The LED names I1 ACTV, I1 L/RX, H1 LNK1/LNK2, and D1 RX appear only in CPU 3680.

LED Name	Description	Status
H1 LNK2*	USB Host2 LNK (link) Green LED	ON – A USB device is connected. OFF – No link exists between the CPU and the MotoTrbo radio.
PI1 TX	Plug-in Port 1 – TX (transmit) Green LED	ON- Transmitting Data
PI1 RX	Plug-in Port 1– RX (receive) Green LED	ON – Receiving Data
PI1 CM	Plug-in Port 1 – CM (channel monitor) Green LED	ON – Channel Busy (if port is in use by radio, RS485, or RS232) – Network Connected (if an IP plug-in is used)
SI1 TX	Serial Port 1 – TX (transmit) Green LED	ON – Transmitting Data
SI1 RX	Serial Port 1 – RX (receive) Green LED	ON – Receiving Data
SI1 CM	Serial Port 1 – CM (channel monitor) Green LED	ON – Channel Monitor is ON.
S2 TX	Serial Port 2 – TX (transmit) Green LED	ON – Transmitting Data
S2 RX	Serial Port 2 – RX (receive) Green LED	ON – Receiving Data
S2 CM	Serial Port 2 – CM (channel monitor) Green LED	ON – Channel Monitor is ON
E1 LNK**	Ethernet Port 1 (link) Green LED	ON – Network Connected In case of RAM test and startup failure, see Table 4-2 and Table 4-3.
E1 RX**	Ethernet Port 1 (receive) Green LED	ON – Receiving Data In case of RAM test and startup failure, see Table 4-2 and Table 4-3.

* The LED names I1 ACTV, I1 L/RX, H1 LNK1/LNK2, and D1 RX appear only in CPU 3680.

** The LED names E1 LNK and RX appear only in CPU 3640 and CPU 3680.

LED Name	Description	Status
I1 ACTV*	Internal Port 1 (INTR1) for Redundancy (active) Green LED	ON – This CPU is the active CPU. OFF – This CPU is the standby CPU or the system does not include Redundancy.
I1 L/RX**	Internal Port 1 (INTR1) for Redundancy (link/receive) Green LED	ON – There is a link between the active and standby CPUs. Blinking – There is a link between the active and standby CPUs and data is being received. OFF – The system does not include Redundancy.
PI2 TX	Plug-in Port 2 – TX (transmit) Green LED	ON – Transmitting Data
PI2 RX	Plug-in Port 2 – RX (receive) Green LED	ON – Receiving Data
PI2 CM	Plug-in Port 2 – CM (channel monitor) Green LED	ON – Channel Busy (if port is in use by radio, RS485, or RS232) – Network Connected (if an IP plug-in is used)
D1 RX**	For future use	For future use
USR1-USR4	User application program LEDs Green LED	Controlled by the user application program. Light consecutively and repeatedly one after the other when entering boot mode.

** The LED names E1 LNK and RX appear only in CPU 3640 and CPU 3680.

* The LED names I1 ACTV, I1 L/RX, H1 LNK1/LNK2, and D1 RX appear only in CPU 3680.

CPU 3610[*]/CPU 3640 Module Specifications

Microprocessor	Freescale – Power PC II MPC8270, 32-bit, extended communication capability, DMA and floating point calculation support
Microprocessor Clock	200 MHz
Memory	Flash: 16 MB/3 MB free for user DRAM: 32 MB/10 MB free for user SRAM plug-in (Optional): 4 MB total, all free for user
Real-Time Clock	Full calendar with leap year support (year, month, day, hours, minutes, seconds). Time drift: max. 2.5 Seconds per day (when power is on)
SRAM and RTC Retention	3 V Rechargeable lithium backup battery
Serial Port 1	Configurable RS232 or RS485 port: - RS232: Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS485, multi-drop 2-Wire up to 230.4 kb/s
Serial Port 2	RS232, Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface
Ethernet Port 1	10/100 Mb/s (on CPU 3640 only)
Plug-In Port 1	Supports the following plug-in ports: - Radio Modem, DPSK 1.2 kb/s, FSK 1.2/1.8/2.4 kb/s, DFM 2.4/3.6/4.8 kb/s - RS232, Sync/Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS485, multi-drop 2-Wire up to 230.4 kb/s - Ethernet 10/100 Mb/s
Plug-In Port 2	Supports the following plug-in ports: - Radio Modem, DPSK 1.2 kb/s, FSK 1.2/1.8/2.4 kb/s, DFM 2.4/3.6/4.8 kb/s - RS232, Sync/Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS485, multi-drop 2-Wire up to 230.4 kb/s - Ethernet 10 Mb/s
LEDs Display	4 CPU diagnostic LEDs, Port status LEDs and user application LEDs
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Operating Voltage	10.8-16 V DC (from the motherboard connector)
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 0.38 Kg (0.84 Lb)

Specifications subject to change without notice.

[*] The CPU 3610 model has been discontinued.

CPU 3680 Module Specifications

Microprocessor	Freescale – Power PC II MPC8270, 32-bit, extended communication capability, DMA and floating point calculation support
Microprocessor Clock	200 MHz
Memory	Flash: 32 MB/19 MB free for user SDRAM: 128 MB/100 MB free for user SRAM plug-in (Optional): 4 MB total, all free for user
Real-Time Clock	Full calendar with leap year support (year, month, day, hours, minutes, seconds). Time drift: max. 2.5 Seconds per day (when power is on)
SRAM, RTC, and Security Chip Retention	3 V Rechargeable lithium backup battery
USB Host Port 1, 2	Type A host full speed 12 Mbs ports (HU1 on left and HU2 on right) for MDLC over IP communication via the MotoTrbo digital mode radio system (on CPU 3680 only). For MotoTrbo radio only; No other USB devices or USB Hubs are supported.
Serial Port 1	Configurable RS232 or RS485 port: - RS232: Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS485, multi-drop 2-Wire up to 230.4 kb/s
Serial Port 2	RS232, Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface
Ethernet Port 1	Ethernet 10/100 Mb/s
USB Device Port 1	USB device port, Type B connector (for future use)
Internal Ethernet Port 1	Internal 100 Mb/s Ethernet port (for redundant CPU interconnection)
Plug-In Port 1	Supports the following plug-in ports: - Radio Modem, DPSK 1.2 kb/s, FSK 1.2/1.8/2.4 kb/s, DFM 2.4/3.6/4.8 kb/s - RS232, Sync/Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS485, multi-drop 2-Wire up to 230.4 kb/s - Ethernet 10/100 Mb/s
Plug-In Port 2	Supports the following plug-in ports: - Radio Modem, DPSK 1.2 kb/s, FSK 1.2/1.8/2.4 kb/s, DFM 2.4/3.6/4.8 kb/s - RS232, Sync/Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS485, multi-drop 2-Wire up to 230.4 kb/s - Ethernet 10 Mb/s
LEDs Display	4 CPU diagnostic LEDs, Port status LEDs and user application LEDs
Module Replacement	Hot swap replacement – module extraction/insertion under voltage in redundant systems only.
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.

Operating Voltage	10.8-16 V DC (from the motherboard connector)
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 0.38 Kg (0.84 Lb)

Specifications subject to change without notice.

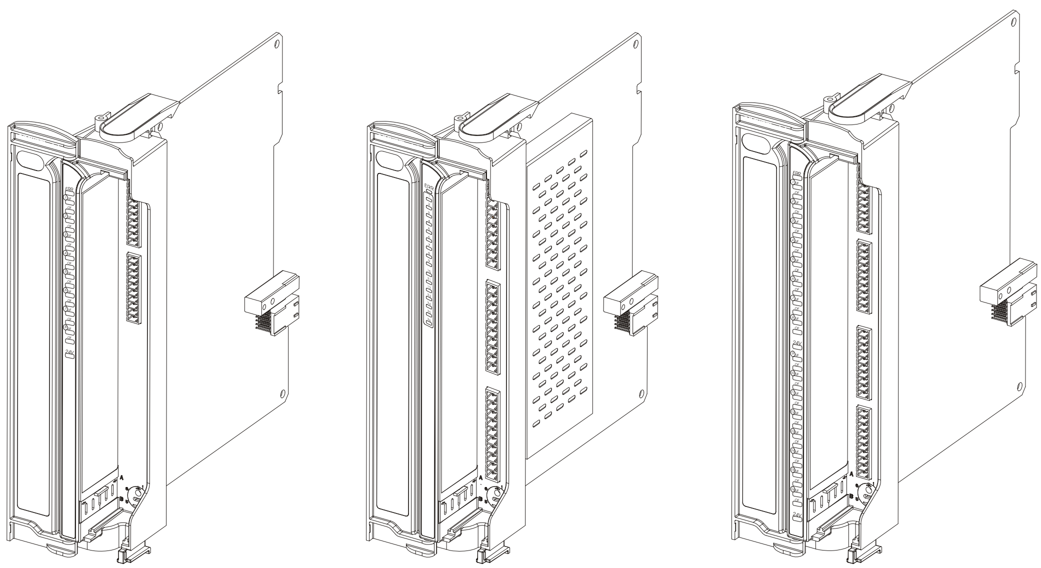
I/O MODULES

General Description

The ACE3600 RTU can include up to eight I/O modules, depending on the frame size. A variety of I/O modules are available. Additional I/O modules can be added using the I/O Expansion frame. For information, see the I/O Expansion chapter below.

The I/O modules can be positioned in the slots to the right of the CPU. As with all ACE3600 modules, the I/O modules can be replaced while the power is on (hot-swap.)

Figure 5-1 provides a general view of an ACE3600 I/O module.



I/O Module with Two TBs   I/O Module with Three TBs   I/O Module with Four TBs

Figure 5-1 ACE3600 I/O Module – General View

Each I/O module includes an ERR status LED, individual I/O status LEDs, an array of I/O connectors, and a coding mechanism for the terminal cable connector or TB holder option.

Figure 5-2 provides a detailed view of the I/O front panel.

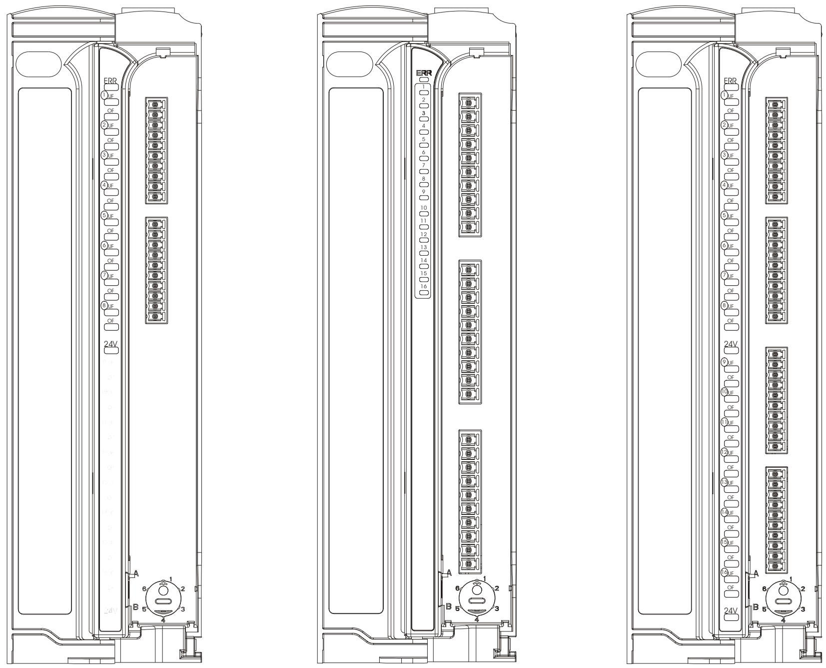


Figure 5-2 ACE3600 I/O Module – Front Panel (without TB Holder)

I/O Module LEDs

The ERR LED indicates an I/O module fault and errors. It will remain lit until all the errors have been eliminated. Diagnostic and error messages can be retrieved from the module using the ACE3600 STS Error Logger or SW Diagnostics. For more information, see the ACE3600 STS User Guide.

The I/O status LEDs in Digital Input (DI) and Digital Output (DO) modules indicate ON and OFF (LED lit when the I/O is ON.) In Analog Input (AI) modules, each input has two LEDs, indicating Overflow (OF) and Underflow (UF). In Analog Output (AO) modules, each output has three LEDs, indicating voltage output (Vout), current output (Iout), and calibration (Cal). In the 8 DO Select Before Operate (SBO) module, the Controlled DO LED indicates whether 12V is controlled or not.

I/O Module Test

The I/O modules can be tested using the STS Hardware Test utility. For more information, see the ACE3600 STS User Guide.

The I/O module LEDs can be tested using the STS Hardware Test utility– all the LEDS are lit for a number of seconds, and then turned back to their previous state.

Panel Terminal Block (TB) Connectors

Each I/O module is equipped with a set of two, three or four TB connectors. Each TB connector has a fixed female side on the module and a male plug for the sensor/device wire connection. The TB male side in all modules is screw type for up to 1mm (18 AWG) wire in modules with two/four TBs (3.5 mm pitch) or 1.6 mm (14 AWG) wire in modules with three

TBs (5 mm pitch). A TB holder can also be ordered for all I/O module types. (See TB Holder and Cables below.) Two TB extractor tools (FHN7063A) are provided for easy removal of TBs, one for modules with two/four TBs and one for modules with three TBs.

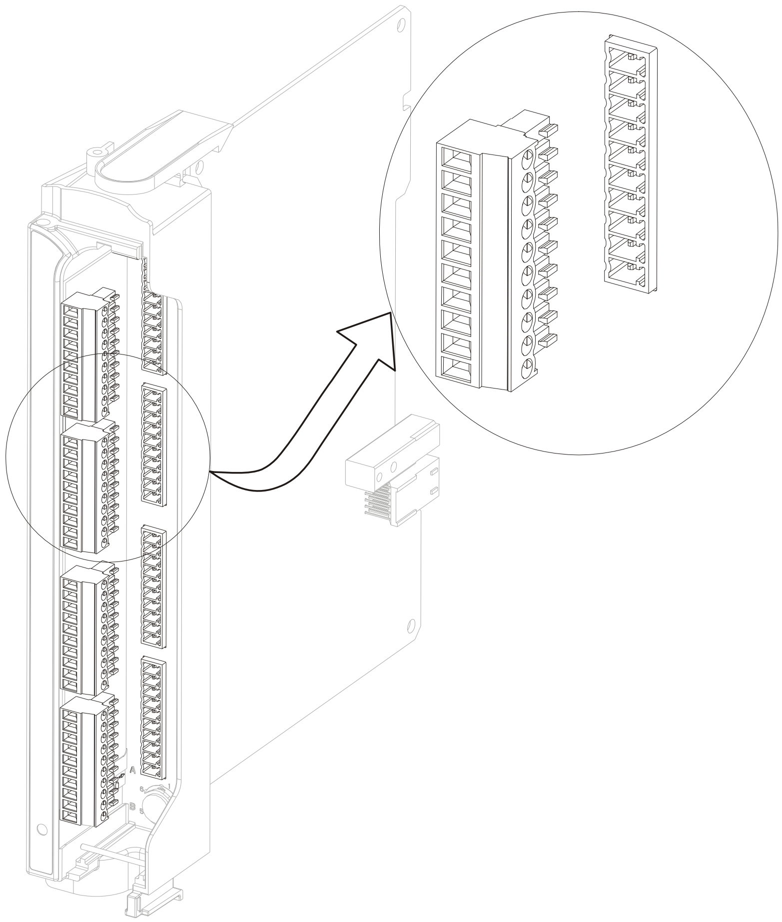


Figure 5-3 TB Connector-Male/Female

Procedure 5-1 Extracting the TB Connector from the I/O Module

1) Open the door of the I/O module to expose the TB connectors (2-4).

2) Position the TB extractor over the desired TB connector, with the small notch facing to the right. (See Figure 5-4.)

3) Press the center of the TB extractor from both sides to open the two sides of the clamp end.

4) Clamp the open TB extractor over the desired TB connector and pull on the back handle to extract the TB connector from the I/O module.

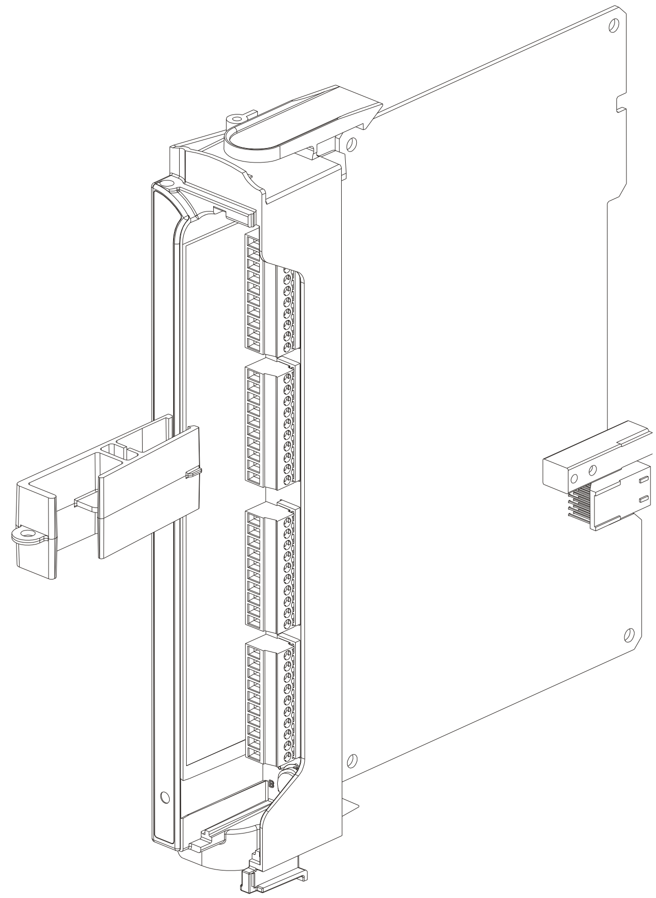


Figure 5-4 TB Extractor

TB Holder and Cables

The TB holder secures the male TBs neatly in place and forms a single connector plug per module. The wires connected to the TBs are concealed in the holder. The module and the TB holder provide a coding mechanism to prevent cabling errors. Ejector handles enable easy release of the TB holder connector from the module. An optional three-meter cable braid, completely wired with holder and cable, is available.

A TB holder kit is available to enable self-assembly of cables. User assembled cables should use wires of up to 0.4mm (26 AWG) in modules with two/four TBs (3.5 mm pitch) or wires of up to 0.8 mm (20 AWG) in modules with three TBs (5 mm pitch). The TB holder kit does not include a cable.

Note that a Philips screwdriver is required for assembling the TB holder and a flat screwdriver is required for setting the code key pin.

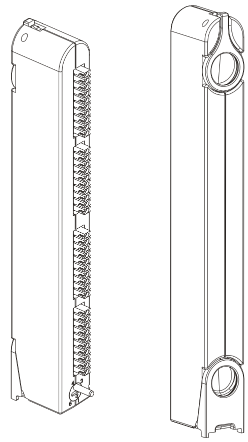


Figure 5-5 Terminal Block (TB) Holder-Front and Back View

Assembling the TB Holder Parts

Procedure 5-1 Assembling the TB Holder Parts

If the TB holder kit is ordered, follow the procedure below. (See Figure 5-6.)

1) Prepare the cable by cutting the wires to fit the TBs. Connect the wires of the user-assembled cables to the TBs, following the pin descriptions on the module panel label (where pin 1 is at the top of first TB and so on downwards.)

2) Place the TBs onto the left part of the TB holder plastic.

3) Add the top ejector handle, the code key and the positioner.

4) Close the right side of the plastic TB holder over the left side.

5) Screw together the assembly using the three screws provided in the kit.
Note the lower screw holds the positioner into place.)

6) Insert the lower ejector handle at the bottom of the TB holder.

7) Slide the metal axis into lower ejector handle from the side.

Once the TB holder is assembled, it can be connected to the I/O module.

Figure 5-6 provides an exploded view of the TB holder assembly for four TBs.

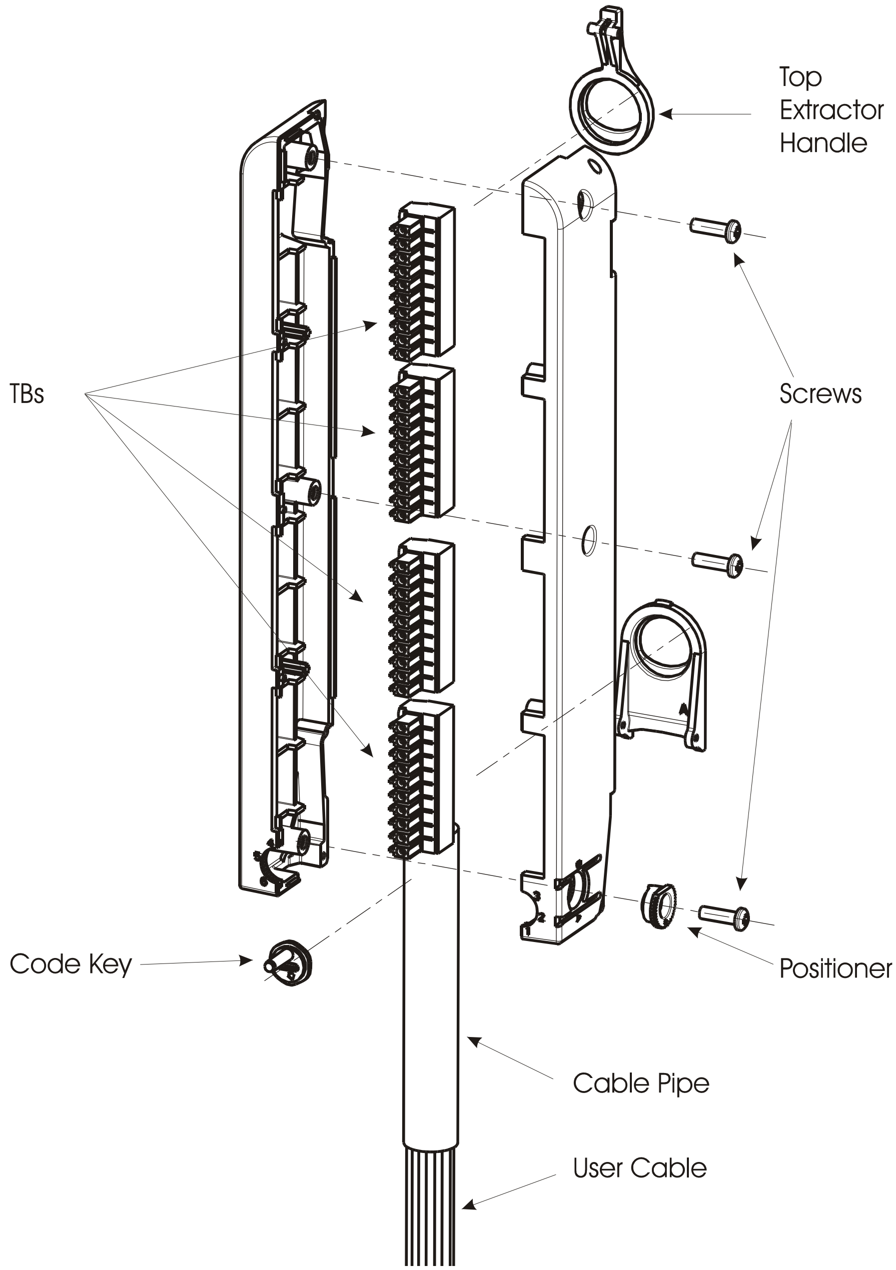


Figure 5-6 Terminal Block (TB) Holder Assembly – Exploded View with Coding

Attaching the TB Holder Clip to the I/O Module

An optional TB holder clip can be added to the I/O module to secure the cable.

Procedure 5-2 Attaching the TB Holder Clip to the I/O Module

1) Remove the I/O module from the ACE3600 RTU.

2) Using the supplied screw, attach the TB holder clip to the bottom of the I/O module. (See Figure 5-7.)

3) Replace the I/O module in the RTU slot.

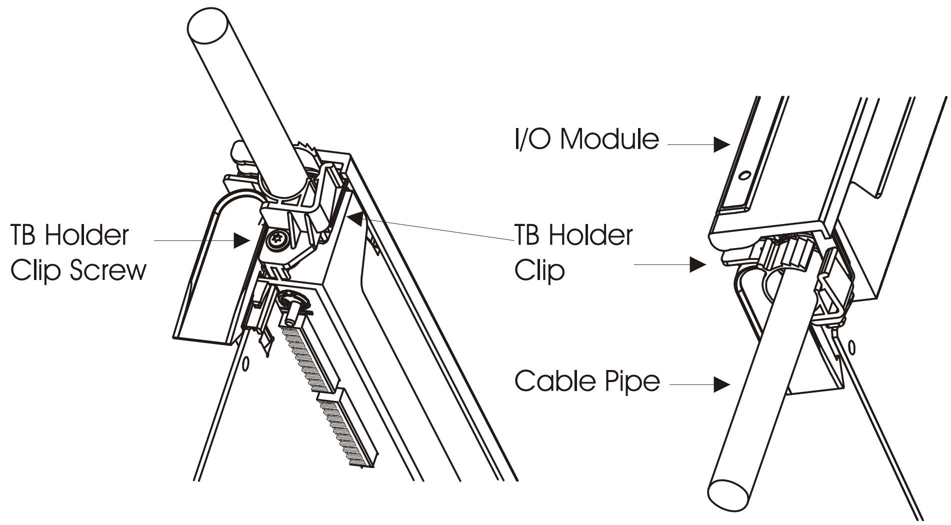


Figure 5-7 I/O Module with Terminal Block (TB) Holder Clip

Connecting the TB Holder to the I/O Module

Procedure 5-3 Connecting the TB Holder to the I/O Module

1) Open the door of the I/O module.

2) On the TB holder, loosen the screw and turn the positioner so that the arrow points to either A or B.

3) Tighten the screw.

4) With a flat screwdriver, set the code key pin to a number from 1 to 6.

5) On the I/O module, using a flat screwdriver, set the pin to the same number (from 1 to 6.) This ensures that the TB holder will not be accidentally connected to the wrong I/O module.

6) Slide the plastic lip on the bottom of the I/O module to either A (up) or B (down) (as in Step 2).

7) Align the plastic lip with the flat edge of positioner on the TB holder and snap the TB holder into the I/O module, (see Figure 5-8), fitting the code key pin into the code key.

8) If the ejector handles are extended, push them inwards, against the TB holder (see Figure 5-8.)

9) If a TB holder clip was attached to the I/O module, slide the cable between the two edges of the clip, and press the clip closed to secure the TB holder to the module. See Figure 5-7.

10) Label the TBs wires with any desired user notes. The wires are numbered 1-20 or 1-40 depending on the model. The wire numbers correspond to the module pins.

11) To extract the TB holder from the I/O module front panel, extend the ejector handles outward away from the module and pull on the handles.

Figure 5-8 provides a general view of the TB holder and an I/O module.

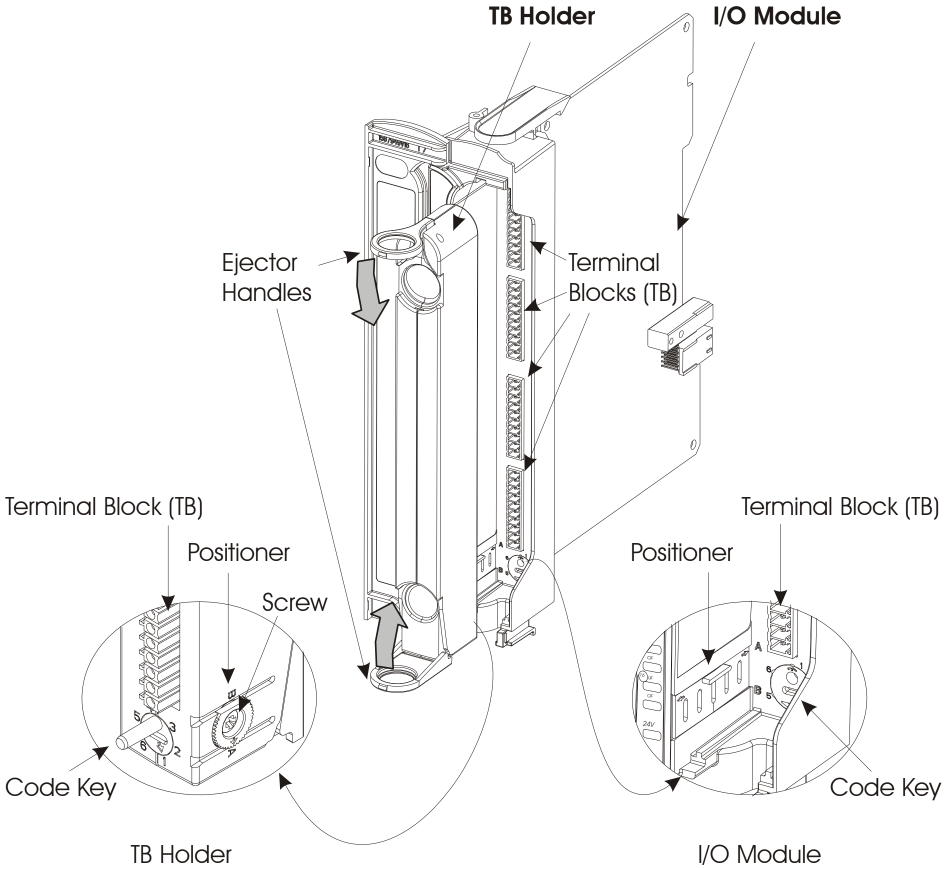


Figure 5-8 Terminal Block (TB) Holder on I/O Module – General View with Coding

Wired Cable Braid

The optional three-meter cable braid is completely wired with a TB holder and either 20-wire or 40 wire cable. Each wire in the cable is labeled with the corresponding pin number. This information is useful when connecting the PGND to the grounding strip. See the Connecting I/O Modules to Ground section of the Installation chapter.

User Label

Each I/O module is provided with a blank label on the module door for user notes.

Inserting/Removing an I/O Module from the Frame

I/O modules support hot-swap and can be inserted and extracted while the system is powered up. For instructions on removing/inserting an I/O module from/into a frame, see the Replacing an I/O Module section of the Break-Fix Procedures chapter below.

Note: The hot-swap of an I/O module in the expansion frame of an RTU which is running without a configuration from the STS (i.e. running the default configuration as from the factory) will not be successful in the following situation: If the expansion module restarts while the main CPU is running and during this restart, a I/O module is removed. In such a case, when the expansion module powers up, it will not recognize the removed I/O module and will not report the hot-swap to the main CPU when the I/O module is replaced in the slot.

Automatic Module ID

Each I/O module has a unique module type ID number. When the RTU is powered up or when an I/O module is inserted into a slot (hot-swap), the CPU automatically identifies the module type.

The module ID can be viewed from the STS Hardware Test utility. For more information, see the Hardware Test section of the ACE STS User Guide.

24V DC Floating Plug-In Power Supply

Up to two 24V DC floating plug-in power supplies can be added to certain I/O modules, as detailed in the table below. Up to four 24V DC floating plug-in power supplies can be added per power supply module. (For guidelines on remaining within the maximum system power consumption, see Appendix D: ACE3600 Maximum Power Ratings below.)

Table 5-1 Number of Plug-In Power Supplies in ACE3600 I/O Modules

Module Type	Number of Power Supplies
32 DI Fast 24V/IEC TYPE 2	2
16 DI Fast 24V/IEC TYPE 2	1
16 AI	1
8 AI	1
Mixed I/O	1
Mixed Analog	1

The plug-in power supply is ordered separately.

Before installing the 24V DC floating plug-in power supply card on the I/O module, please verify that the FPGA version of the I/O module is as follows:

I/O Module Type	FPGA Version
AI module (all types)	Version 1.5.002 or higher.
DI module (all types)	Version 2.1.004 or higher.
Mixed I/O module (all types)	Version 1.5.004 or higher.

Use the ACE36000 STS Hardware Test utility to retrieve the FPGA version from the unit. If the FPGA version listed in the Module Diagnostics is lower than the version in the chart above, you must upgrade the I/O version by downloading a higher version FPGA file using the STS. Contact your local support team for the updated FPGA file.

Procedure 5-4 Attaching the Power Supply to the I/O Module

Attach the power supply to the I/O module using the following procedure. Note that a TORX screwdriver is required.

1) Remove the cap from the 40-pin connector on the power supply plug-in.
2) Place the plug-in onto the board with the connector attached and the spacers over the holes on the board.
3) Screw the four supplied metals screws into the spacers to secure the plug-in.
   The RTU will automatically recognize the 24V power supply.

Each plug-in power supply output is controlled by the CPU module. By default, the plug-in power supply is ON and can supply up to 150mA. The power supply plug-in can be turned ON/OFF via the user application program or Hardware Test utility.

Figure 5-9 provides a general view of an I/O module with one plug-in.

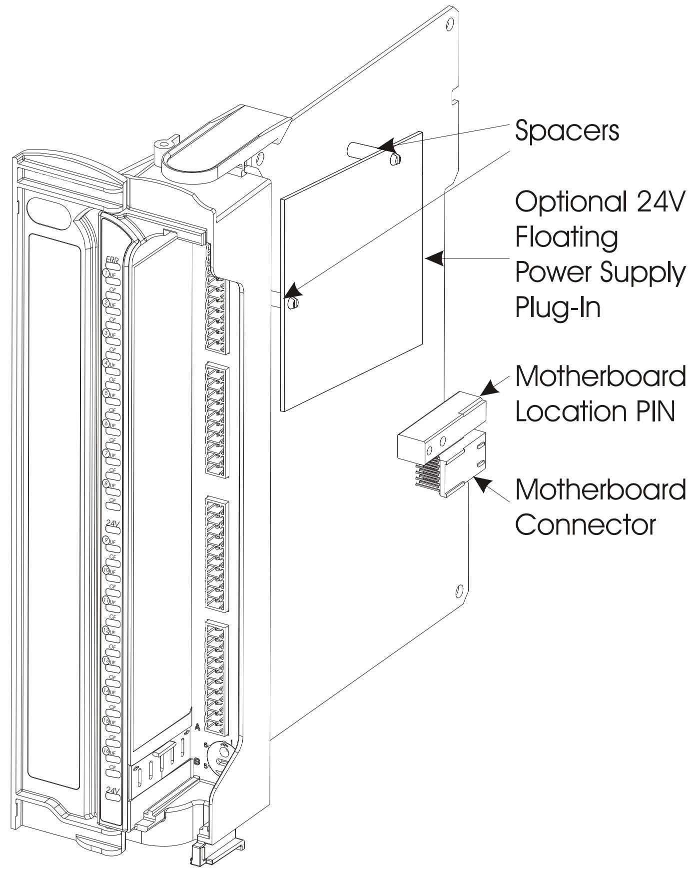


Figure 5-9 ACE3600 I/O Module with a 24V Floating Power Supply Plug-In

24V DC Floating Plug-In Power Supply Module Detailed Specifications

Input Voltage	10.8-16 V (from I/O module)
Outputs	24V floating, max. 150 mA
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Efficiency	75% typical
Protection	Automatic output shut down on overvoltage and overcurrent
Insulation	Input to output: 1500 V AC
Dimensions	78 mm W x 15 mm H x 68 mm D (3.1" W x 0.6" H x 2.7" D)
Weight	Approx. 0.04Kg (0.09 Lb)

Specifications subject to change without notice.

DIGITAL INPUT MODULE

General Description

The ACE3600 Digital Input (DI) module can have 16 or 32 inputs.

The following DI modules are available.

- 16 DI Fast 24V
- 32 DI Fast 24V
- 16 DI Fast 24V IEC TYPE 2
- 32 DI Fast 24V IEC TYPE 2
- 32 DI Fast 48V

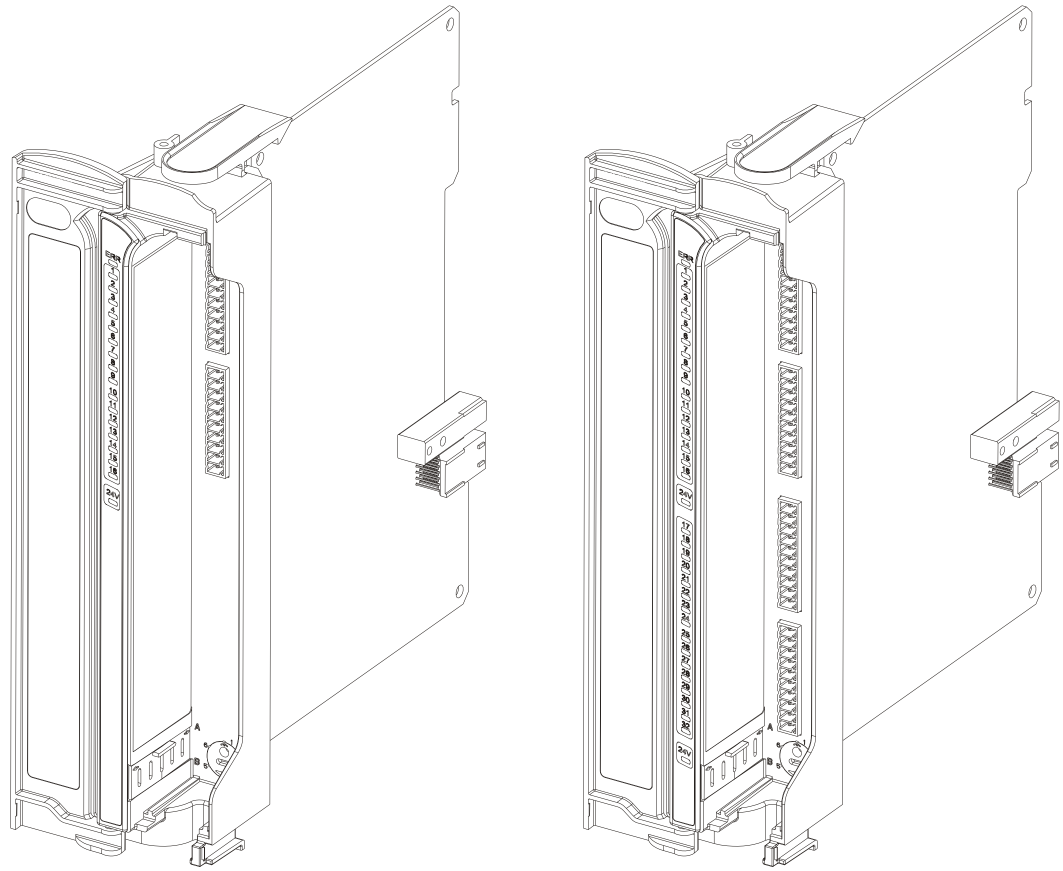
Two types of voltage (“wet”) inputs are supported, IEC 61131-2 Type II compliant inputs and 24V “MOSCAD compatible” inputs. In the 32 DI module, the first 20 inputs can function as fast counters. In the 16 DI module, all inputs can function as fast counters. A counter's maximum rate is dependent on the module type (see the specifications below.)

All the inputs are optically isolated. All DI modules except the 32 DI 48V module support optional 24V DC floating plug-in power supplies (for contact “wetting” or other purposes).

Each DI can be an event trigger (interrupt-driven) to a high priority fast process. The high priority fast process enables very fast activation of an output in response to an input trigger and logical conditions. This high priority fast process is not dependent on the I/O scan (refer to the STS Application Programmer manual.)

For a description of I/O module construction, location, LEDs, TBs, and other common I/O module features, see the I/O Modules chapter above.

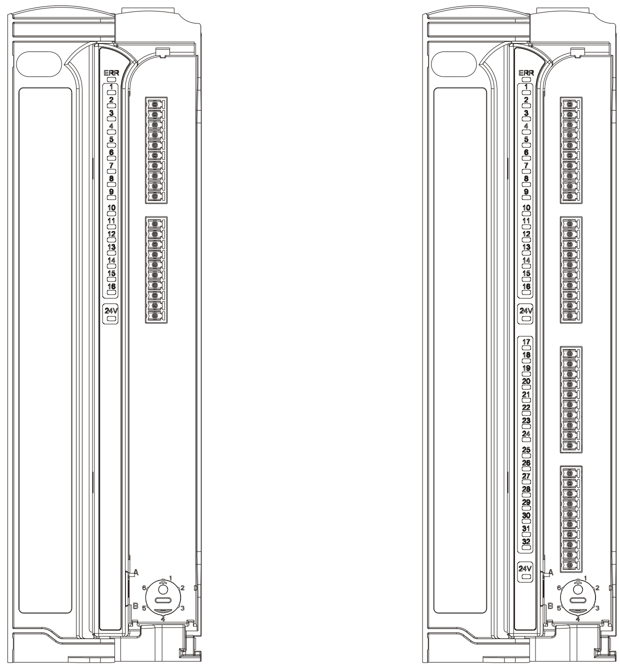
Figure 6-1 provides a general view of the ACE3600 DI module.



16 DI Module **32 DI Module**

Figure 6-1 ACE3600 DI Module – General View

Figure 6-2 provides a detailed view of the ACE3600 DI module front panel.



16 DI Module **32 DI Module**

Figure 6-2 ACE3600 DI Module – Front Panel

DI Module Configuration

The 16 DI Fast 24V and 32 DI Fast 24V modules can handle AC and DC input signals. The user can select DC or AC operation per module. When AC configuration is selected, the Fast Capture, Counter Function and Input Filters (see below) are disabled. The 32 DI 48V modules can handle DC input signals only.

Fast Capture (DC Configuration)

When the DI module is in DC mode, each DI can be configured as a Fast Capture DI. Fast capture causes the SCAN ladder output operation to get the first change that occurred since the previous scan. When fast capture is disabled, the scan gets the current value of the DI (in this case, any DI changes between scans are missed.)

Input Filters (DC Configuration)

When the DI module is in DC mode, each input has a HW input filter to make sure that the input reading is stable. The range of the HW DI filter is 0 to 50.8 millisecond (in 0.2 mS steps). The Fast Counter DI filter range is 0 to 12.75 millisecond (in 0.05 mS steps).

Event Time Tagging

Each DI can be set in the user application program's I/O link table to trigger recording of time tagged events upon any input change of state. The time tagged events are recorded in the CPU memory and can be retrieved for various purposes.

Keep Last Value (KLV) and Predefined Value (PDV)

Each input can be configured to KLV or to a PDV (0, 1). This value is shown to the user application program in the event of DI module failure. The PDV can also be used during normal operation to force a value that masks the actual input value. In this case the user program will get the PDV instead of the actual input value.

DI Module Configuration Options

The DI module features which can be configured are listed in the table below. Some parameters are per module and some are per input.

Table 6-1 ACE3600 DI Module Configurable Features

Feature	Parameter Settings	Default Setting	Per Module / Input	Parameter Setup Location
DC or AC operation*	AC / DC	DC	Module	STS site configuration
Fast Capture	Disabled /Enabled	Disabled	Input	STS site configuration
DI Filter (DC)	0-254 (x 0.2 mS)	50 * 0.2 mS (=10 mS)	Module	STS site configuration; 'C' User Program
Counter Filter (DC)	0-255 (x 0.05 mS)	20 * 0.2 mS (= 1 ms)	Module	STS site configuration 'C' User Program
Event Time Tagging	Disabled/ Enabled	Disabled	Input	User Program I/O link table
Keep Last Value and Predefined Value	KLV/PDV PDV=0/1	KLV	Input	User Program I/O link table
Mask	No /Yes	No	Input	User Program I/O link table

* in Fast 24V IEC TYPE II modules –only DC

Sleep Mode

Each DI module can be switched by the user application program to Sleep Mode. In Sleep Mode, the module does not function and the power consumption is minimized. During Sleep mode, the user application program will get the predefined values (PDV) for each I/O.

Module Status and Diagnostics

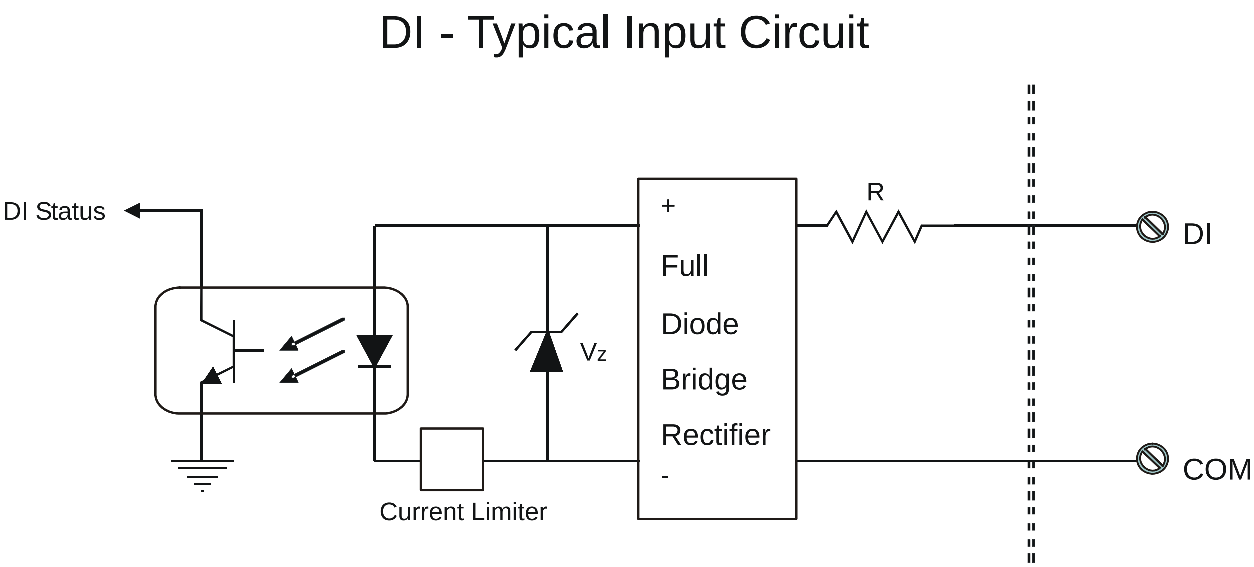
In the event of DI Module failure, the I/O module ERR LED will be lit. This event is registered by the CPU in the Error Logger. DI Module failure status is also visible to the user application program.

The DI module can be diagnosed and monitored using the STS Hardware Test utility. This test verifies that the module is operational, presents the module configuration and shows the actual value of each input. It is also possible to change the input filter setup temporarily for the duration of the Hardware Test.

In the Hardware Test utility, it is possible to set the DI module to Freeze Mode. In this mode the user application program will get the predefined value of each input in the module, instead of the actual input value. Freeze mode enables testing the inputs while the user application program is running.

For details on configuring the DI modules, see the Site Configuration section, and the Application Programming section of the STS User Guide.

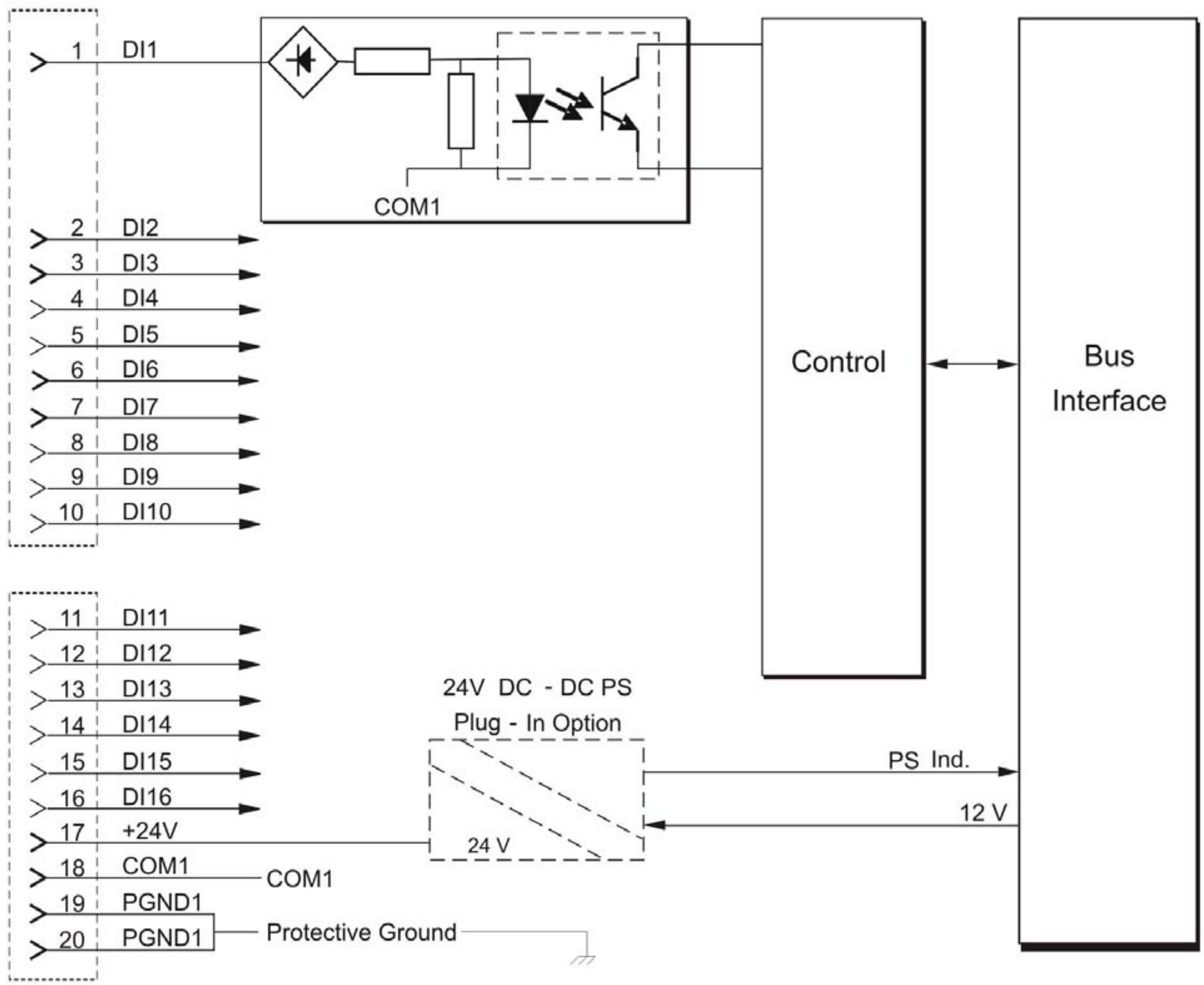
I/O Circuit Diagram



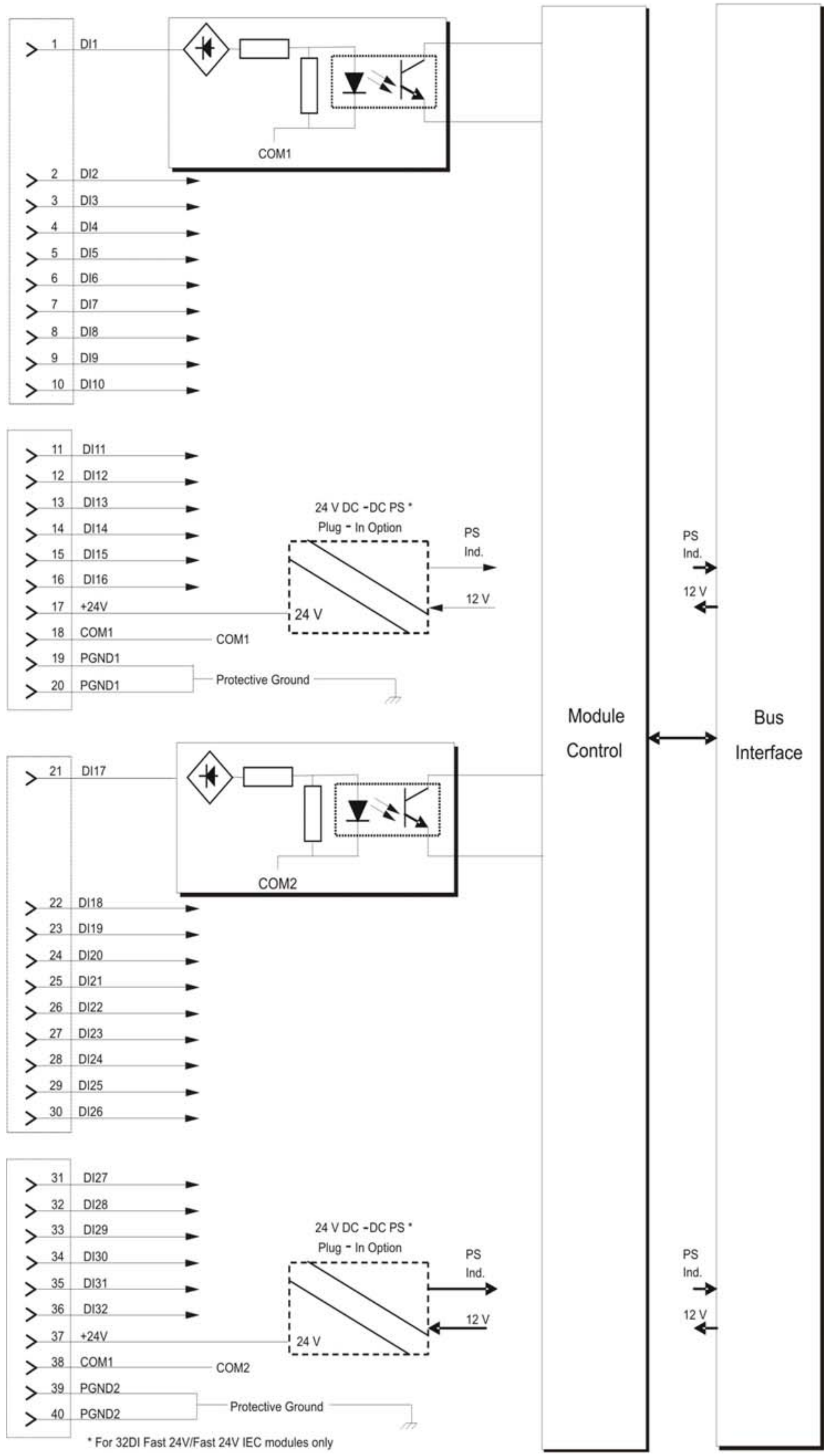
	Fast 24V	Fast 48V
R	255Ω	3.32KΩ
Vz	33V	68V
Current Limiter	3.5mA	3mA

Module Block Diagram

16 DI



32 DI



1 DI1
COM1
2 DI2
3 DI3
4 DI4
5 DI5
6 DI6
7 DI7
8 DI8
9 DI9
10 DI10
11 DI11
12 DI12
13 DI13
14 DI14
15 DI15
16 DI16
17 +24V
18 COM1
19 PGND1
20 PGND1
24 V DC -DC PS *
Plug - In Option
PS
Ind.
12 V
24 V
COM1
Protective Ground
Module
Control
Bus
Interface
21 DI17
COM2
22 DI18
23 DI19
24 DI20
25 DI21
26 DI22
27 DI23
28 DI24
29 DI25
30 DI26
31 DI27
32 DI28
33 DI29
34 DI30
35 DI31
36 DI32
37 +24V
38 COM1
39 PGND2
40 PGND2
COM2
Protective Ground
* For 32DI Fast 24V/Fast 24V IEC modules only

Connection Charts

16 DI

Pin	Function	Pin	Function
1	DI1	11	DI11
2	DI2	12	DI12
3	DI3	13	DI13
4	DI4	14	DI14
5	DI5	15	DI15
6	DI6	16	DI16
7	DI7	17	+24V
8	DI8	18	COM1
9	DI9	19	PGND1
10	DI10	20	PGND1

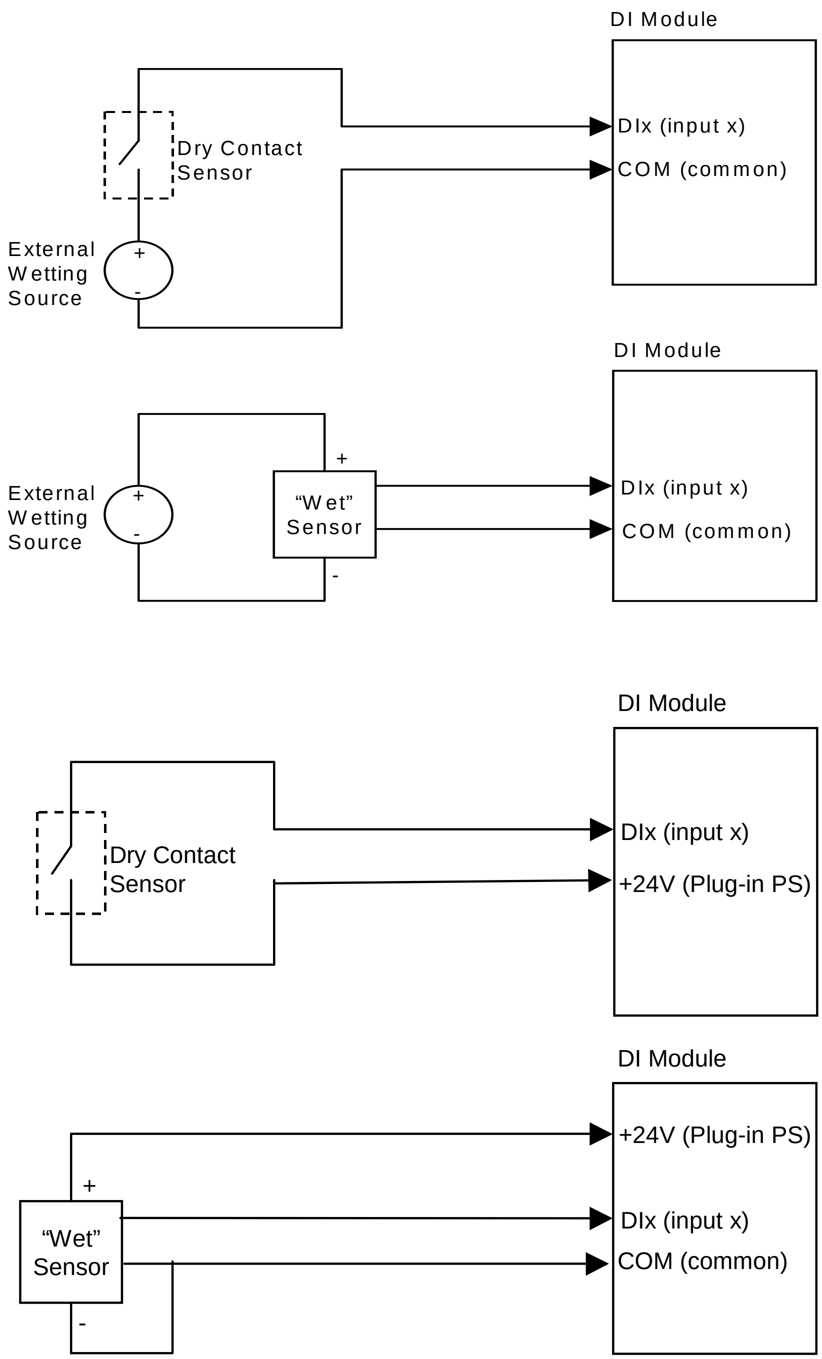
32 DI

Pin	Function	Pin	Function
1	DI1	21	DI17
2	DI2	22	DI18
3	DI3	23	DI19
4	DI4	24	DI20
5	DI5	25	DI21
6	DI6	26	DI22
7	DI7	27	DI23
8	DI8	28	DI24
9	DI9	29	DI25
10	DI10	30	DI26
11	DI11	31	DI27
12	DI12	32	DI28
13	DI13	33	DI29
14	DI14	34	DI30
15	DI15	35	DI31
16	DI16	36	DI32
17	+24V[*]	37	+24V[*]
18	COM1	38	COM2
19	PGND1	39	PGND2
20	PGND1	40	PGND2

[*] In 32 DI 24V modules only.

I/O Connection Diagram

Connection of a dry contact sensor to the DI module requires “wetting” the contact with a voltage. This can be done using the 24V DC floating plug-in power supplies that can be added to the module (in 16/32 DI Fast 24V/ Fast 24V IEC TYPE 2 modules only). The 24V can be also used to power “wet” sensors.



DI Module Specifications

16/32 DI FAST 24V Modules	
Total Number of Inputs	16 DI; 32 DI
Input Arrangement	Isolated groups of 16 inputs with shared common
Fast Counter Inputs	Inputs that can be used as fast counters: - All inputs in 16 DI module; - First 20 inputs in 32 DI module
AC Input Frequency	45 – 65 Hz
AC Input Delay	Maximum 0.2 mS
Fast Counter Input Frequency	0 - 12.5 KHz, minimum pulse width 40 µS
Max. DC Input Voltage	Max. ±40 V DC (relative to input common)
“ON” DC Voltage Range	+9 to +30 V DC, -30 to -9 V DC
“OFF” DC Voltage Range	-3 to +3 V DC
“ON” AC Voltage Range	10 to 27 V AC (RMS)
“OFF” AC Voltage Range	0 to 5 V AC (RMS)
Input Current	Max. 3.5 mA
Fast Capture Resolution	1 mS (Interrupt upon change of state)
Event Time Tagging Resolution	1 mS (Interrupt upon change of state)
Input Filtering	0 to 50.8 mS (DC, programmable in 0.2 mSec steps)
Counter Input Filtering	0 to 12.75 mS (programmable in 0.05 mSec steps for inputs configured as high speed counters)
24 V DC Output	Supports optional isolated 24 V plug-in “Wetting” Power Supply (one in 16 DI, two in 32 DI)
Diagnostic LEDs	Status LED per each input, module error LED, 24V plug-in status LED
User Connection	2 or 4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable and TB Holder	20 or 40 Wire Cable with TB Holder connector, 26 AWG wires
Module Replacement	Hot swap replacement – module extraction/insertion under voltage
Input Isolation	2.5 kV RMS between input and module logic per IEC60255-5
Input Insulation	Insulation resistance 100 MΩ @ 500 V DC per IEC60255-5
Operating Voltage	10.8-16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Dimensions	37 mm W x 225 mm H x 180 mm D, (1.5“ W x 8.7“ H x 7.1“ D)
Weight	16 DI: approx. 0.28 Kg (0.62 Lb); 32 DI: approx. 0.29 Kg (0.63 Lb)

16/32 DI FAST 24V IEC 61131-2 TYPE II Modules	
Total Number of Inputs	16 DI 32 DI
Input Arrangement	Isolated groups of 16 inputs with shared common
Fast Counter Inputs	Inputs that can be used as fast counter: - All inputs in 16 DI module - First 20 inputs in 32 DI module
Fast Counter Input Frequency	0 - 10 KHz, minimum pulse width 50 µS
Max. DC Input Voltage	Max. ±40 V DC (relative to input common)
"ON" DC Voltage Range	+11 to +30 V DC, -30 to -11 V DC
"OFF" DC Voltage Range	-5 to +5 V DC
Input Current	6-10 mA
Fast Capture Resolution	1 mS (Interrupt upon change of state)
Event Time Tagging Resolution	1 mS (Interrupt upon change of state)
Input Filtering	0 to 50.8 mS (DC, programmable in 0.2 mSec steps)
Counter Input Filtering	0 to 12.75 mS (programmable in 0.05 mSec steps for inputs configured as high speed counter)
24V DC Output	Supports optional isolated 24 V plug-in "Wetting" Power Supply (one in 16 DI, two in 32 DI)
Diagnostic LEDs	Status LED per each input, module error LED, 24V Plug-in status LED
User Connection	2 or 4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable and TB Holder	20 or 40 Wire Cable with Terminal Block Holder connector, 26 AWG wires
Module Replacement	Hot swap replacement – module extraction/insertion under voltage
Input Isolation	2.5 kV RMS between input and module logic per IEC60255-5
Input Insulation	Insulation resistance 100 MΩ @ 500 V DC per IEC60255-5
Operating Voltage	10.8-16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption (measured at power supply in)	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Dimensions	37 mm W x 225 mm H x 180 mm D, (1.5" W x 8.7" H x 7.1" D)
Weight	16 DI: approx. 0.28 Kg (0.62 lb) 32 DI: approx. 0.29 Kg (0.63 lb)

32 DI FAST 48V Modules	
Total Number of Inputs	32 DI
Input Arrangement	Isolated groups of 16 inputs with shared common
Fast Counter Inputs	Inputs that can be used as fast counters: First 20 inputs
Fast Counter Input Frequency	2.0 KHz (minimum pulse width 250 µS)
Max. DC Input Voltage	Max. ±72 V DC (relative to input common)
"ON" DC Voltage Range	+36 to +60 V DC
"OFF" DC Voltage Range	0 to +6 V DC
Input Current	Max. 3 mA
Fast Capture Resolution	1 mS (Interrupt upon change of state)
Event Time Tagging Resolution	1 mS (Interrupt upon change of state)
Input Filtering	0 to 50.8 mS (DC, programmable in 0.2 mSec steps)
Counter Input Filtering	0 to 12.75 mS (programmable in 0.05 mSec steps for inputs configured as high speed counters)
Diagnostic LEDs	Status LED per each input, module error LED
User Connection	4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable and TB Holder	40 Wire Cable with TB Holder connector, 26 AWG wires
Module Replacement	Hot swap replacement – module extraction/insertion under voltage
Input Isolation	2.5 kV RMS between input and module logic per IEC60255-5
Input Insulation	Insulation resistance 100 MΩ @ 500 V DC per IEC60255-5
Operating Voltage	10.8-16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Dimensions	37 mm W x 225 mm H x 180 mm D, (1.5" W x 8.7" H x 7.1" D)
Weight	16 DI: approx. 0.28 Kg (0.62 Lb); 32 DI: approx. 0.29 Kg (0.63 Lb)

Specifications subject to change without notice.

DIGITAL OUTPUT/DIGITAL INPUT FET MODULE

General Description

The Digital Output/Digital Input (DO/DI) FET module has 16 or 32 configurable user connections, organized in four groups. Each group can be configured as an 8 DO group or as an 8 DI group.

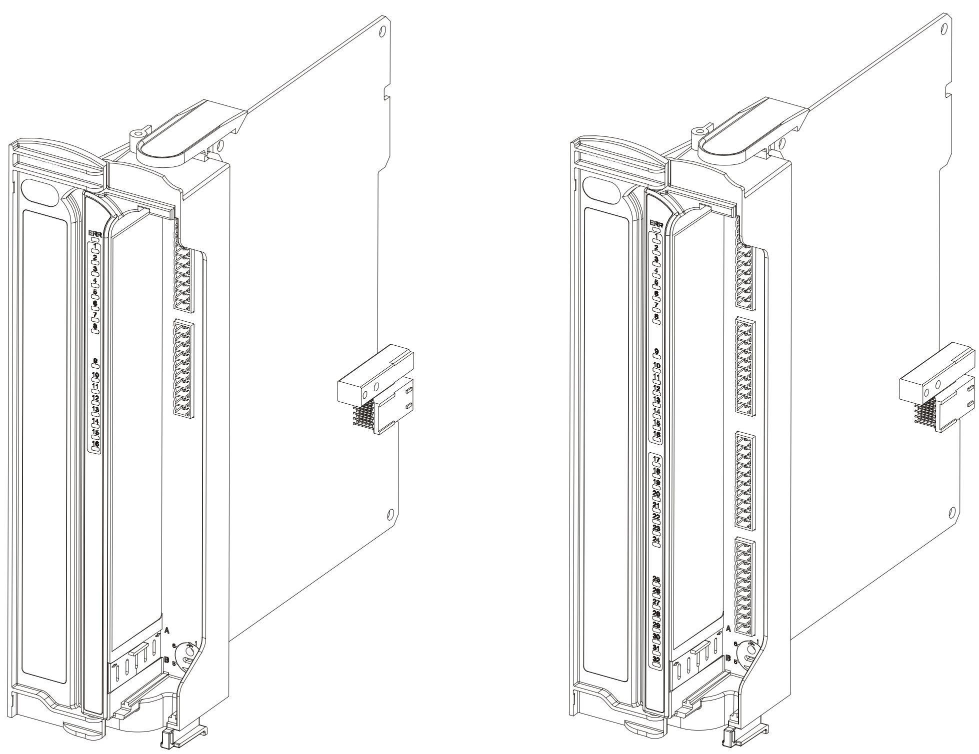
The following Digital Output/Digital Input (DO/DI) FET modules are available.

- 16 (DO/DI) FET
- 32 (DO/DI) FET

The outputs are optically isolated current sink FET type with back indication. The inputs are optically isolated Dry Contact type with internal “wetting” voltage.

For a description of I/O module construction, location, LEDs, TBs, and other common I/O module features, see the I/O Modules chapter above.

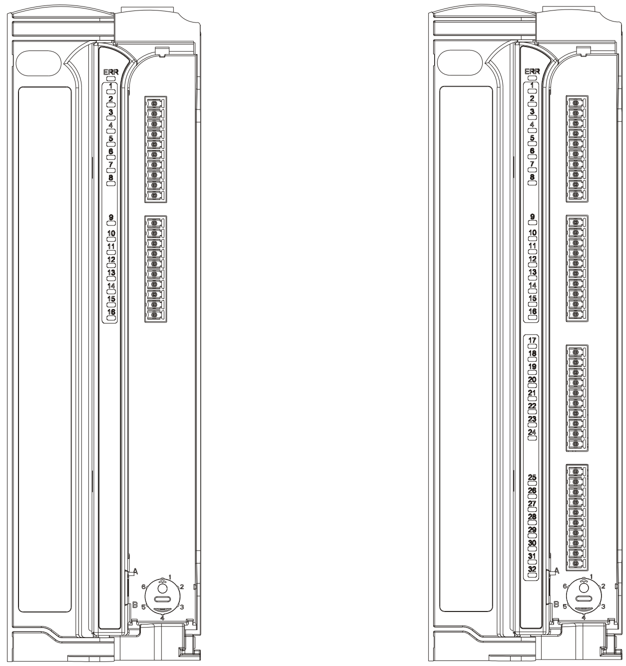
Figure 8-1 provides a general view of the ACE3600 DO/DI FET module.



16 DO/DI FET Module **32 DO/DI FET Module**

Figure 8-1 ACE3600 DO/DI FET Module – General View

Figure 8-2 provides a detailed view of the ACE3600 DO/DI FET module front panel.



16 DO/DI FET Module **32 DO/DI FET Module**

Figure 8-2 ACE3600 DO/DI FET Module – Front Panel

Module Configuration

Input/Output

The following combinations can be configured in the STS site configuration (16 DO/DI).

I/O combination	DI location	DO location
16DO	-	1-16
8DI + 8DO	1-8	9-16
16DI	1-16	-

The following combinations can be configured in the STS site configuration (32 DO/DI).

I/O combination	DI location	DO location
32DO	-	1-32
8DI + 24DO	1-8	9-32
16DI + 16DO	1-16	17-32
24DI + 8DO	1-24	25-32
32DI	1-32	-

The appropriate combination is selected as the I/O module type, when configuring the I/Os in the ACE3600 STS site configuration.

DI Fast Capture

Each DI can be configured as Fast Capture DI in the STS advanced I/O configuration. Fast capture causes the SCAN ladder output operation to get the first change that occurred since the previous scan. When fast capture is disabled (default), the scan gets the current value of the DI (in this case DI changes between scans are missed).

DI Input Filters

Each inputs has a hardware input filter to make sure that the input reading is stable. The hardware DI filter range is 0 to 50.8 mS (in 0.2 mS steps). Counter DI filter range is 0 to 12.75 mS (in 0.05 mS steps). The DI filter can be set in the STS advanced I/O configuration.

Note: In this module, the minimum effective filter value is 1 mS.

DI Event Time Tagging

Each DI can be set in the Application Programmer I/O link table to trigger recording of time tagged events upon any input change of state. The time tagged events are recorded in the CPU memory and can be retrieved for various purposes.

DI Keep Last Value (KLV) and Predefined Value (PDV)

Each input can be configured to KLV or to a PDV (0, 1) in the Application Programmer I/O link table. This value is shown to the user application program in the event of DI module failure. Also, the predefined value can be used during normal operation to force a value that masks the actual input value. In this case the user application program will get the PDV instead of the actual input value.

DO Keep Last Value (KLV) and Predefined Value (PDV)

Each output can be configured to KLV or to a PDV (0, 1). This value is executed when the user application program stops or when the module has no communication with the CPU module. Also, the predefined value can be used during normal operation to force a value on the output by ignoring the user application program value.

DO/DI FET Module Configuration Options

The DO/DI FET module features which can be configured are listed in the table below. Some parameters are per module and some are per input.

Table 8-1 ACE3600 DO/DI FET Module Configurable Features

Parameter	Selection	Default Setup	Per Module/ Input	Parameter Setup Location
DI Fast Capture	Disabled /Enabled	Disabled	Input	RTU configuration
DI Filter	0-254 (x 0.2 mS)	50 * 0.2 mS (=10 mS)	Module	RTU configuration; 'C' Program
DI Counter Filter	0-255 (x 0.05 mS)	20 * 0.2 mS (= 1 ms)	Module	RTU configuration; 'C' Program
DI Event Time Tagging	Disabled /Enabled	Disabled	Input	Application Programmer I/O link table
DI Keep Last Value & Predefined Value	KLV/PDV PDV = 0/1	KLV	Input	Application Programmer I/O link table
DI Mask	No /Yes	No	Input	Application Programmer I/O link table
DO Keep Last Value & Predefined Value	KLV/PDV PDV = 0/1	KLV	Output	Application Programmer I/O link table
DO Mask	No /Yes	No	Output	Application Programmer I/O link table

Sleep Mode

Each DO/DI module can be switched by the user application program to Sleep Mode. In Sleep Mode, the module does not function and the power consumption is minimized. During Sleep mode, the user application program will get the KLV or PDV per each DI.

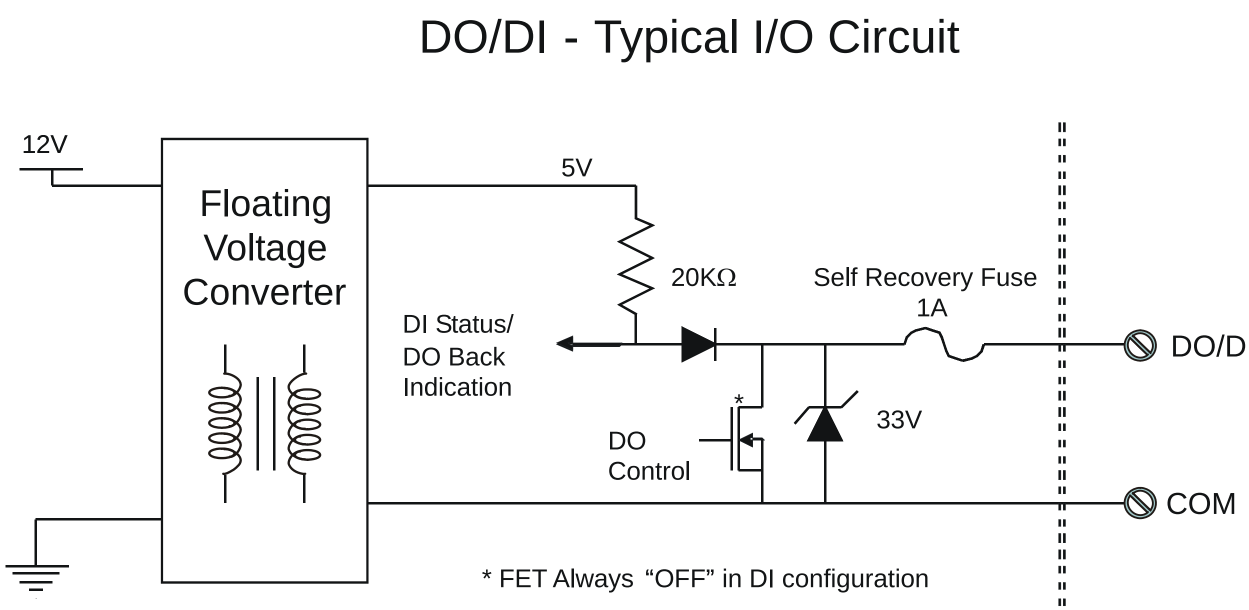
Module Status and Diagnostics

In the event of a DO/DI module failure, the ERR LED on the module will be lit. This event is registered by the CPU in the Error Logger. DO/DI module failure status is also visible to the user application program.

The DO/DI module can be diagnosed and monitored using the STS Hardware Test utility. The Hardware Test verifies that the module is operational, presents the module configuration and shows the actual value of each input and output. It is also possible to change the input filter setup for the duration of the Hardware test and change the value of the DOs.

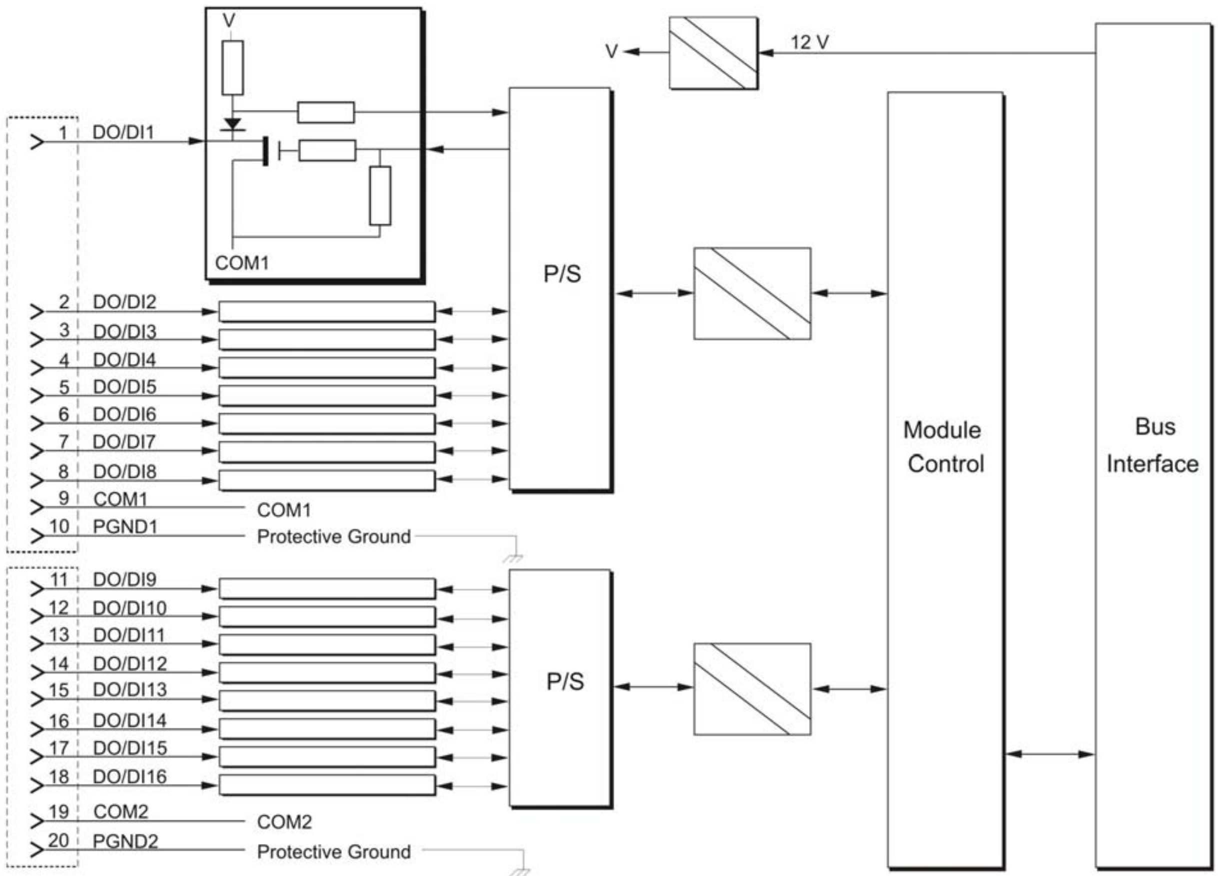
In the Hardware Test utility, it is possible to set the module to Freeze Mode. In this mode the user application program will get the KLV/PDV of each input in the module instead of the actual input value. The DO values will keep the last value they had when the module was switched to Freeze Mode. Freeze mode enables testing the inputs and outputs while the user application program is running.

I/O Circuit Diagram

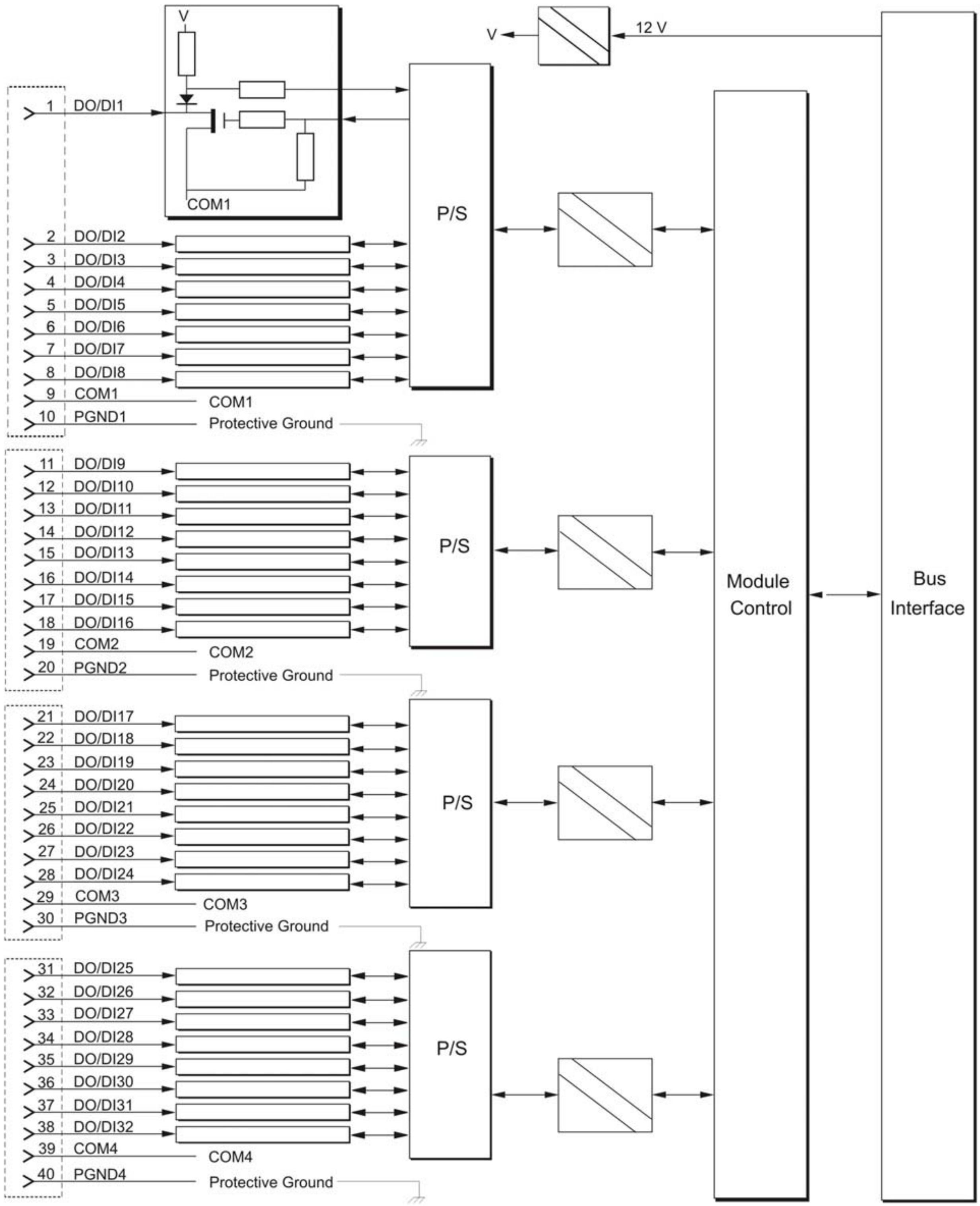


Module Block Diagram

16 DO/DI FET



32 DO/DI FET



V
V
12 V
1 DO/DI1
COM1
P/S
2 DO/DI2
3 DO/DI3
4 DO/DI4
5 DO/DI5
6 DO/DI6
7 DO/DI7
8 DO/DI8
9 COM1
10 PGND1
COM1
Protective Ground
11 DO/DI9
12 DO/DI10
13 DO/DI11
14 DO/DI12
15 DO/DI13
16 DO/DI14
17 DO/DI15
18 DO/DI16
19 COM2
20 PGND2
COM2
Protective Ground
P/S
Module Control
Bus Interface
21 DO/DI17
22 DO/DI18
23 DO/DI19
24 DO/DI20
25 DO/DI21
26 DO/DI22
27 DO/DI23
28 DO/DI24
29 COM3
30 PGND3
COM3
Protective Ground
P/S
31 DO/DI25
32 DO/DI26
33 DO/DI27
34 DO/DI28
35 DO/DI29
36 DO/DI30
37 DO/DI31
38 DO/DI32
39 COM4
40 PGND4
COM4
Protective Ground
P/S

Connection Charts

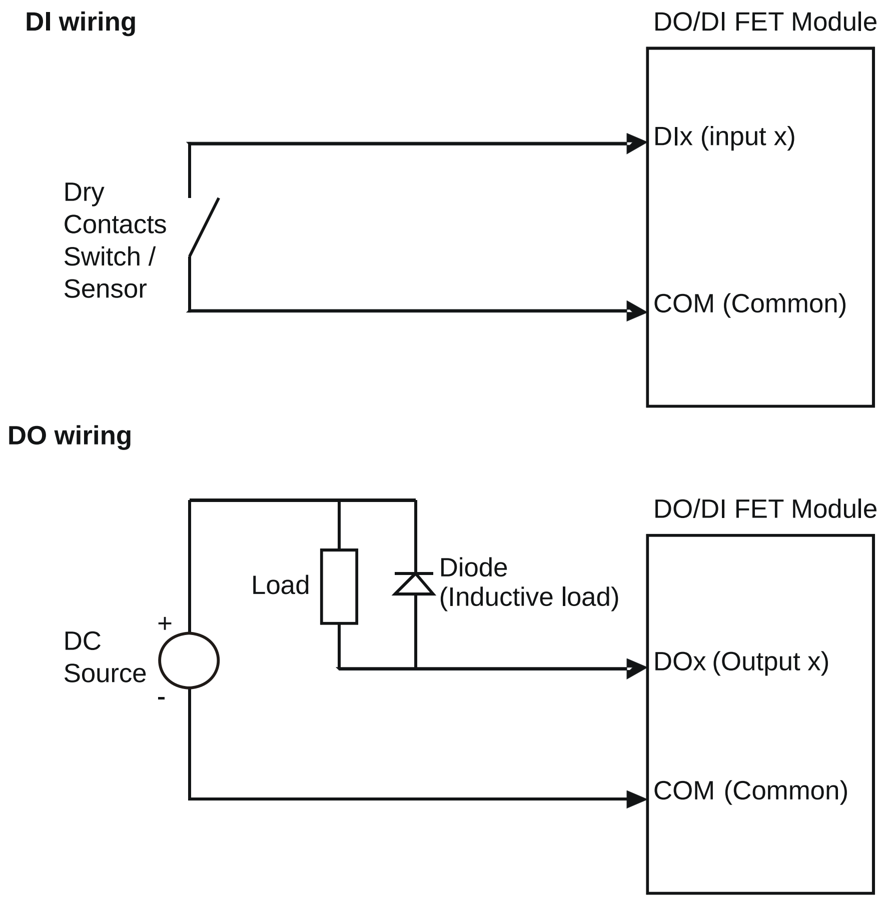
16 DO/DI FET

Pin	Function	Pin	Function
1	DO/DI1	11	DO/DI9
2	DO/DI2	12	DO/DI10
3	DO/DI3	13	DO/DI11
4	DO/DI4	14	DO/DI12
5	DO/DI5	15	DO/DI13
6	DO/DI6	16	DO/DI14
7	DO/DI7	17	DO/DI15
8	DO/DI8	18	DO/DI16
9	COM1	19	COM2
10	PGND1	20	PGND2

32 DO/DI FET

Pin	Function	Pin	Function
1	DO/DI1	21	DO/DI17
2	DO/DI2	22	DO/DI18
3	DO/DI3	23	DO/DI19
4	DO/DI4	24	DO/DI20
5	DO/DI5	25	DO/DI21
6	DO/DI6	26	DO/DI22
7	DO/DI7	27	DO/DI23
8	DO/DI8	28	DO/DI24
9	COM1	29	COM3
10	PGND1	30	PGND3
11	DO/DI9	31	DO/DI25
12	DO/DI10	32	DO/DI26
13	DO/DI11	33	DO/DI27
14	DO/DI12	34	DO/DI28
15	DO/DI13	35	DO/DI29
16	DO/DI14	36	DO/DI30
17	DO/DI15	37	DO/DI31
18	DO/DI16	38	DO/DI32
19	COM2	39	COM4
20	PGND2	40	PGND4

I/O Connection Diagram



DO/DI FET Module Specifications

Total Number of I/Os	16; 32
I/O Arrangement	Two or four group of 8 I/Os with shared common Each group can be configured as FET DO or dry contact DI. Selectable combinations (32 DO/DI): 32 DO/8 DI+24 DO/ 16 DI+16 DO/24 DI+8 DO/32 DI Selectable combinations (16 DO/DI): 16 DO/8 DI+8 DO/16 DI
Counter Inputs	32 DI: 20 first inputs can be used as counter inputs. 16 DI: All 16 inputs can be used as counter inputs.
Counter Input Frequency	0 - 1 KHz, minimum pulse width 500 µS. Note: Although filters are defined in steps of 0.2mSec and 0.05mSec, it is relevant only from 1mSec and above.
Max. DC Input Voltage	Max. 30 V DC (relative to input common)
Input “ON” Resistance	0-4 kΩ
Input “OFF” Resistance	≥50 kΩ
Fast Capture Resolution	1 mS (Interrupt upon change of state)
Event Time Tagging Resolution	1 mS (Interrupt upon change of state)
Input Current	Max. 0.3 mA (when the input is shorted)
Input Filtering	0 to 50.8 mS (programmable in 0.2 mSec steps), minimum effective filter value - 1mSec
Counter Input Filtering	0 to 12.75 mS (programmable in 0.05 mSec steps), minimum effective filter value - 1mSec
Output Type	MOSFET
Output Voltage Range	5-30 V DC (user supplied voltage)
DO Frequency	Max. 1 KHz (resistive load)
DO Output Current	Max. 500 mA sink current (resistive load)
Output Fail State	Configurable output state on CPU fail: On, Off or ‘last value’
Diagnostic LEDs	LED per each input / output status, module error LED
User Connection	4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable and TB Holder	20 or 40 Wire Cable with Terminal Block Holder connector, 26 AWG
Module Replacement	Hot swap replacement– module extraction / insertion under voltage
Input / Output Isolation	1.5 kV between input/output and module logic
Input Insulation	Insulation resistance 100 MΩ @ 500 V DC per IEC60255-5
Operating Voltage	10.8-16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	Approx. 0.25 Kg (0.55 Lb)

Specifications subject to change without notice.

DIGITAL OUTPUT RELAY MODULE

General Description

The DO Relay modules have 8 or 16 outputs.

There are two types of DO relays:

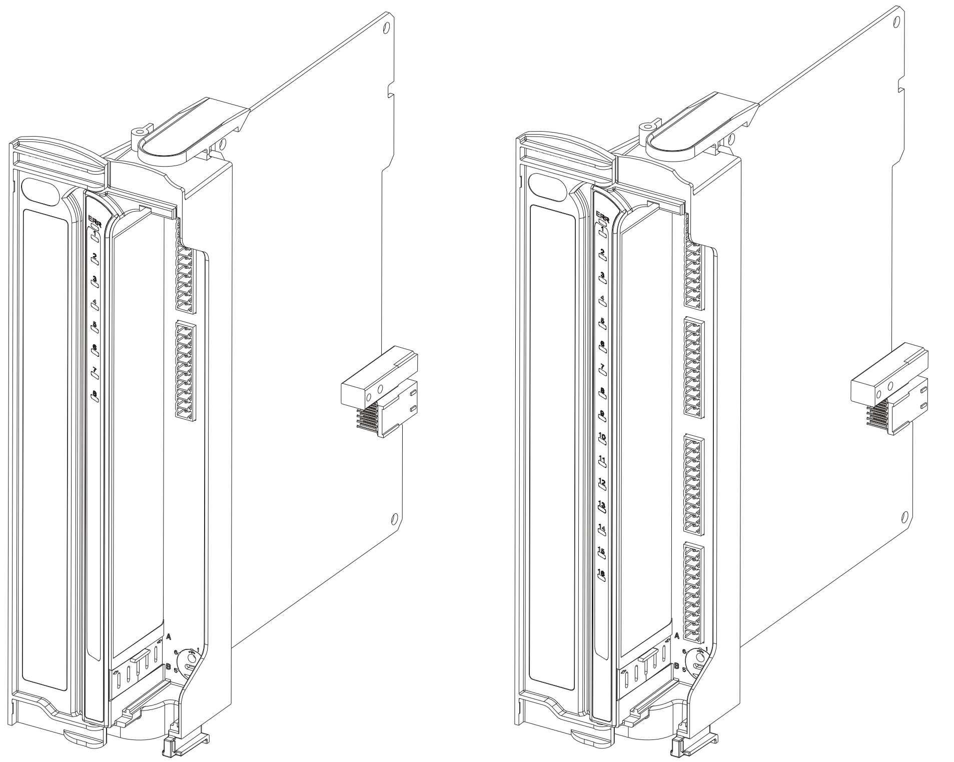
- Electrically Energized (EE) - the outputs return to the non-energized state in case of power off or module failure.
- Magnetically Latched (ML) - Relay outputs are magnetically latched, the outputs maintain their state in case of power off or module failure.

The following DO relays modules are available:

- 8 DO EE Relay 2A
- 16 DO EE Relay 2A
- 8 DO ML Relay 2A
- 16 DO ML Relay 2A

For a description of I/O module construction, location, LEDs, TBs, and other common I/O module features, see the I/O Modules chapter above.

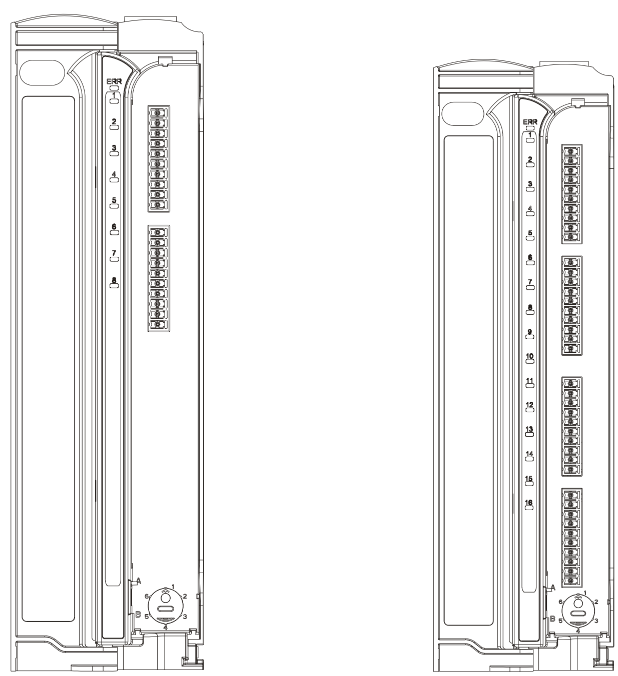
Figure 9-1 provides a general view of the ACE3600 DO Relay Module.



8DO Relay **16 DO Relay**

Figure 9-1 ACE3600 DO Relay Module – General View

Figure 9-2 provides a detailed view of the ACE3600 DO Relay Module front panel.



8DO Relay **16DO Relay**

Figure 9-2 ACE3600 I/O Module – Front Panel

In the 8 DO modules, the relays of outputs 1 through 5 are Single Pole Single Throw (SPST) normally open (NO) and are referred to as the “Form A” relays. The relays of outputs 6 through 8 are Single Pole Double Throw (SPDT) and are referred to as the “Form C” relays.

In the 16 DO modules, the relays of outputs 1 through 5 and 9 through 13 are Single Pole Single Throw (SPST) normally open (NO) “Form A” relays. The relays of outputs 6 through 8 and 14 through 16 are Single Pole Double Throw (SPDT) “Form C” relays.

The physical position of each relay is monitored by the module logic, using a back indication signal which is connected to the relay’s second contact set. Any contradiction between the required position and the back indication signal is reported to the CPU and is available to the user program.

In some applications it is necessary to inhibit relay output operation when attending the site for safety reasons. In all DO relay modules, it is possible to inhibit all relays per DO module. When a module is configured to enable relay inhibiting, the power to the relays is provided from the power supply via a dedicated power line (12V DO), controlled from the “12V DO” input (TB located on the power supply module panel). When the input’s terminals are shorted, the relays are operational. When the input’s terminals are open, the relays are inhibited (EE relays in 0 position and ML relays do not change state.)

Note: In systems with I/O expansion, the power supplies on I/O expansion frames can be attached via DC cable to the power supply on the previous I/O expansion frame in a daisy-chain manner, or directly to the main power supply. In this case, the 12V DO control on the main power supply can control all DO EE relays in the entire RTU that were configured by dip switch for 12V DO. This enables the user to inhibit all DO EE relays in the entire RTU simply by removing the plug from the 12V DO control in the main power supply. For more information, see the I/O Expansion and Expansion Power Supply Module chapters below.

The user program can monitor the relay inhibiting status and act accordingly. Also, when the module’s relays are inhibited, any mismatch between the relay position and the output logical state is ignored.

Module Configuration

Relay Inhibiting

NOTE

When the dip switch is set to 12V DO, the position of the 2-pin 12V DO Control connector on the front panel of the power supply module (see Power Supply Module chapter above) acts as a safety mechanism. When the 2-pin TB is unplugged from the 12V DO Control (e.g. for maintenance), power is not supplied via the motherboard to the relays and the relays are disabled. The 12V DO affects all relays in the system that are programmed to work from the 12V DO and not the (default) 12V Main.

EE relays that are programmed for 12V DO operation will disconnect when

12V DO power is shut down and cannot be changed in this state.
ML relays that are programmed for 12V DO operation will freeze in their current state when 12V DO power is shut down and cannot be changed. Therefore, setting the dip switch for ML will not necessarily inhibit them.

A dual selector dip switch (S3) on the DO Relay module has 4 selectable positions as described in the following table:

Table 9-1 DO Relay Module- Dip Switch Settings

S3 SW 1	S3 SW 2	Configuration mode
OFF	OFF	12V_DO – Relay inhibiting enabled
ON	OFF	Software selectable – inhibiting is set in site configuration
OFF	ON	12V_DO – Relay inhibiting enabled
ON	ON	12 V – (factory default) Relay inhibiting disabled

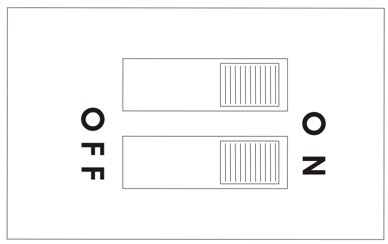


Figure 9-3 12V DO Dip Switch

When S3 is set to Software Selectable mode, the inhibiting configuration is set using the module configuration in the STS Site Configuration (see Table 9-2 below).

Procedure 9-1 describes how to set the 12V DO dip switch to enable relay inhibiting.

Procedure 9-1 How to Set the 12V DO Dip Switch to Enable Relay Inhibiting.

1) If the 2-pin TB is plugged into the 12V DO Control on the front panel of the power supply module, unplug it.
2) Remove the DO module from the slot in the rack.
3) Carefully remove the plastic wrap covering from the S3 dip switch (see Figure 9-3) on the DO module board. Note: Ignore text on the board that OFF/OFF is the factory default.
4) Set the S3 dip switch to the desired position, according to the legend in Table 9-1.
5) Replace the DO module in the rack.
6) If the new dip switch position causes DO relay power to be drawn from the 12VDO, plug the 2-pin TB back into the 12V DO Control on the front panel of the power supply module.

DO Keep Last Value (KLV) and Predefined Value (PDV)

Each output can be configured to KLV or to a PDV (0, 1). This value is executed when the user program stops or when the module has no communication with the CPU module. Also, the

PDV can be used during normal operation to force a value on the output by ignoring the user program value (mask).

Reset DO at Startup

It is possible to configure the module to reset all the ML relays positions on startup. This is set in the STS site configuration.

Table 9-2 ACE3600 DO Relay Module Software Configurable Features

Parameter	Selection	Default Setup	Per Module/ Input	Parameter Setup Location
DO Keep Last Value & Pre Defined Value	KLV/PDV PDV = 0/1	KLV	Output	Application Programmer I/O link table
DO Mask	No /Yes	No	Output	Application Programmer I/O link table
Reset DO at Startup	No/Yes	Yes	Module	Site configuration
Relay Inhibiting (SW selectable)	12V DO (Enabled)/ 12V (Disabled)	12V DO (Enabled)	Module	Site configuration

Sleep Mode

Each DO module can be switched by the user program to Sleep Mode. In Sleep Mode, the module is not functioning and the power consumption is minimized.

Module Status and Diagnostics

In the event of module failure, the module's ERR LED will be lit. This event is registered by the CPU in the Error Logger. Module failure status is also visible to the user program.

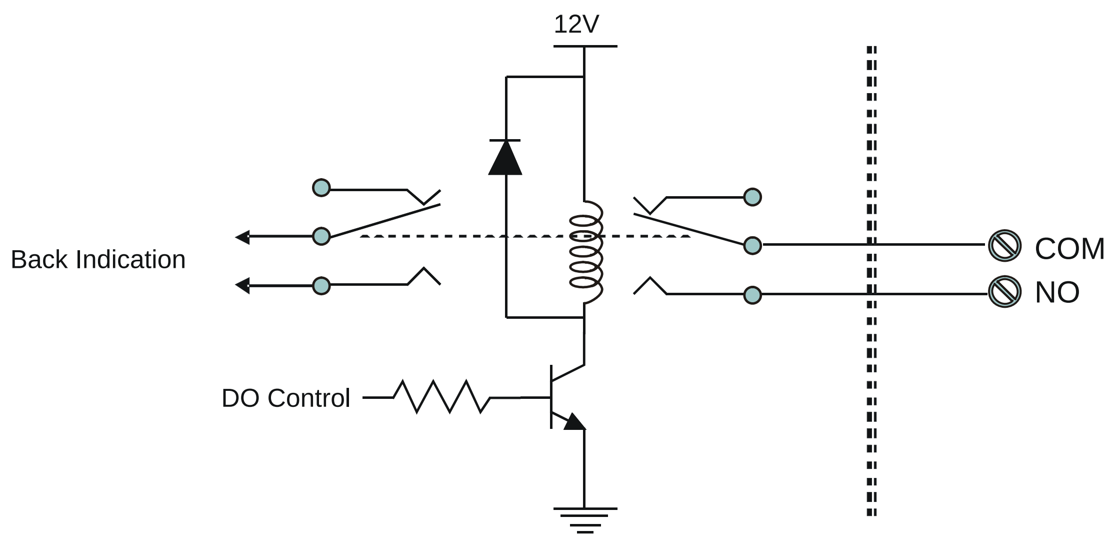
The DO module can be diagnosed and monitored using the STS Hardware Test utility. This test verifies that the module is operational, presents the module configuration and shows the actual value of each output. It is also possible to change the DO's value.

In the Hardware Test utility, it is possible to set the module to Freeze Mode. In this mode, the DOs will keep the last value they had at the time they were frozen. Freeze mode enables testing the inputs and outputs while the user program is running.

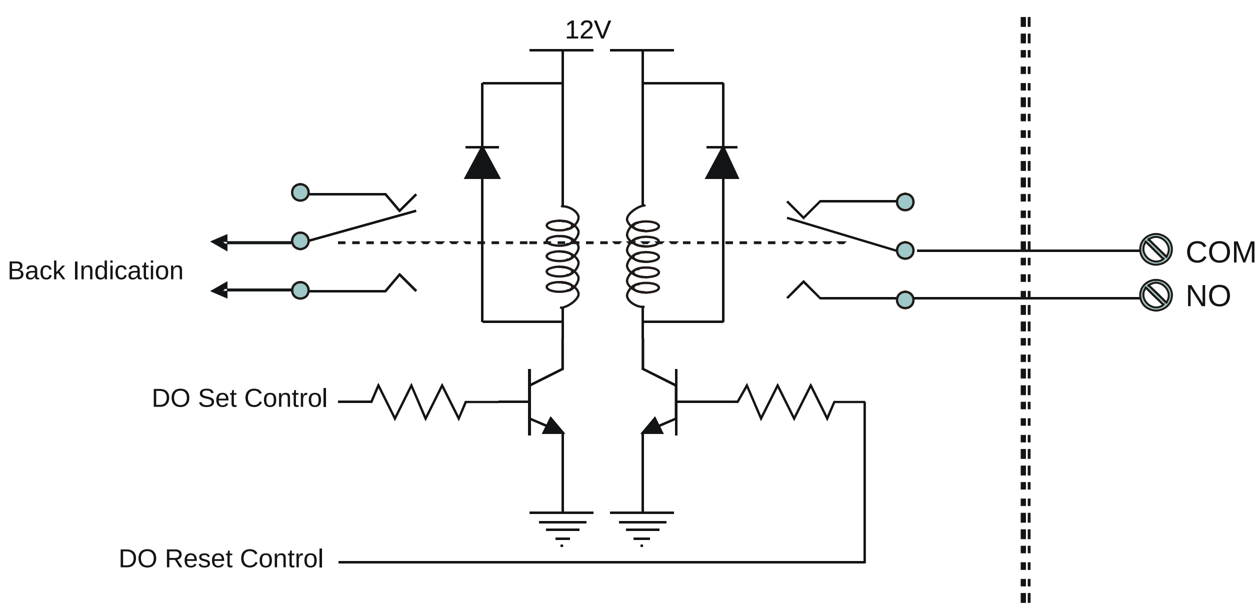
For details on configuring the DO modules, see the Configuring a Site section and the Application Programmer section of the ACE3600 STS User Guide.

I/O Circuit Diagram

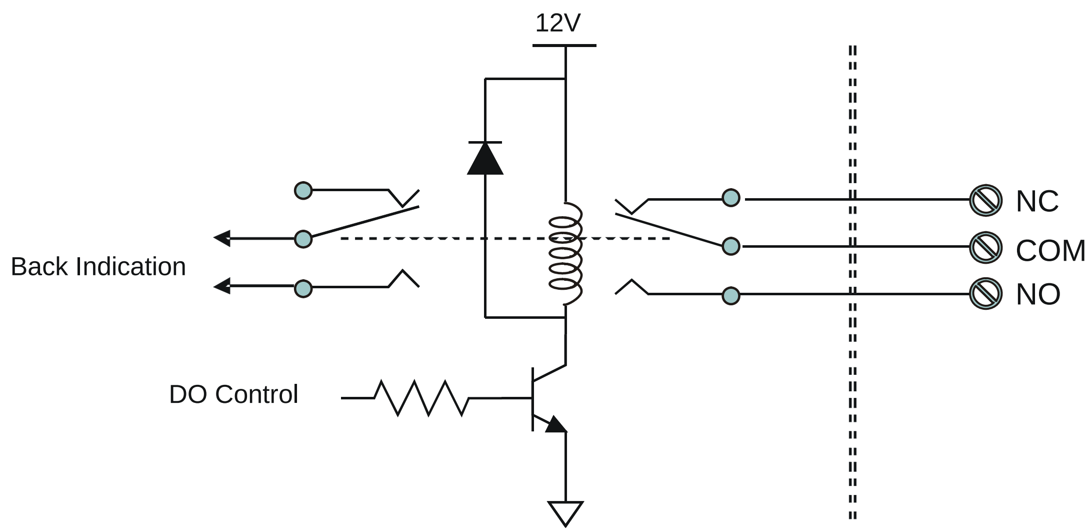
DO EE Relay (SPST) - Typical Output Circuit



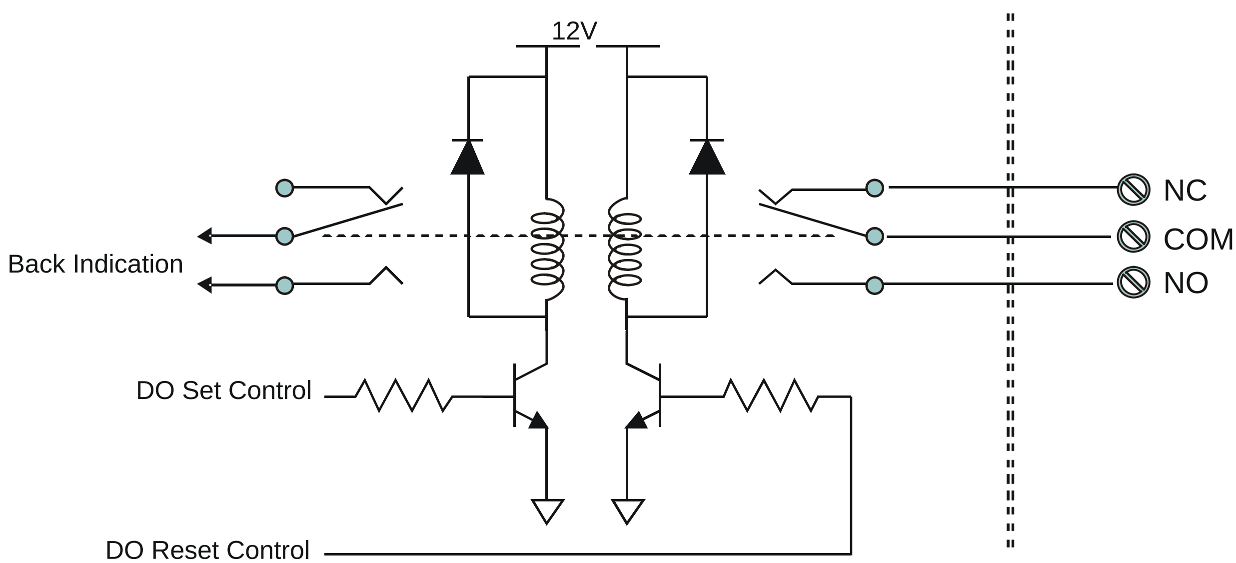
DO ML Relay (SPST) - Typical Output Circuit



DO EE Relay (SPDT) - Typical Output Circuit

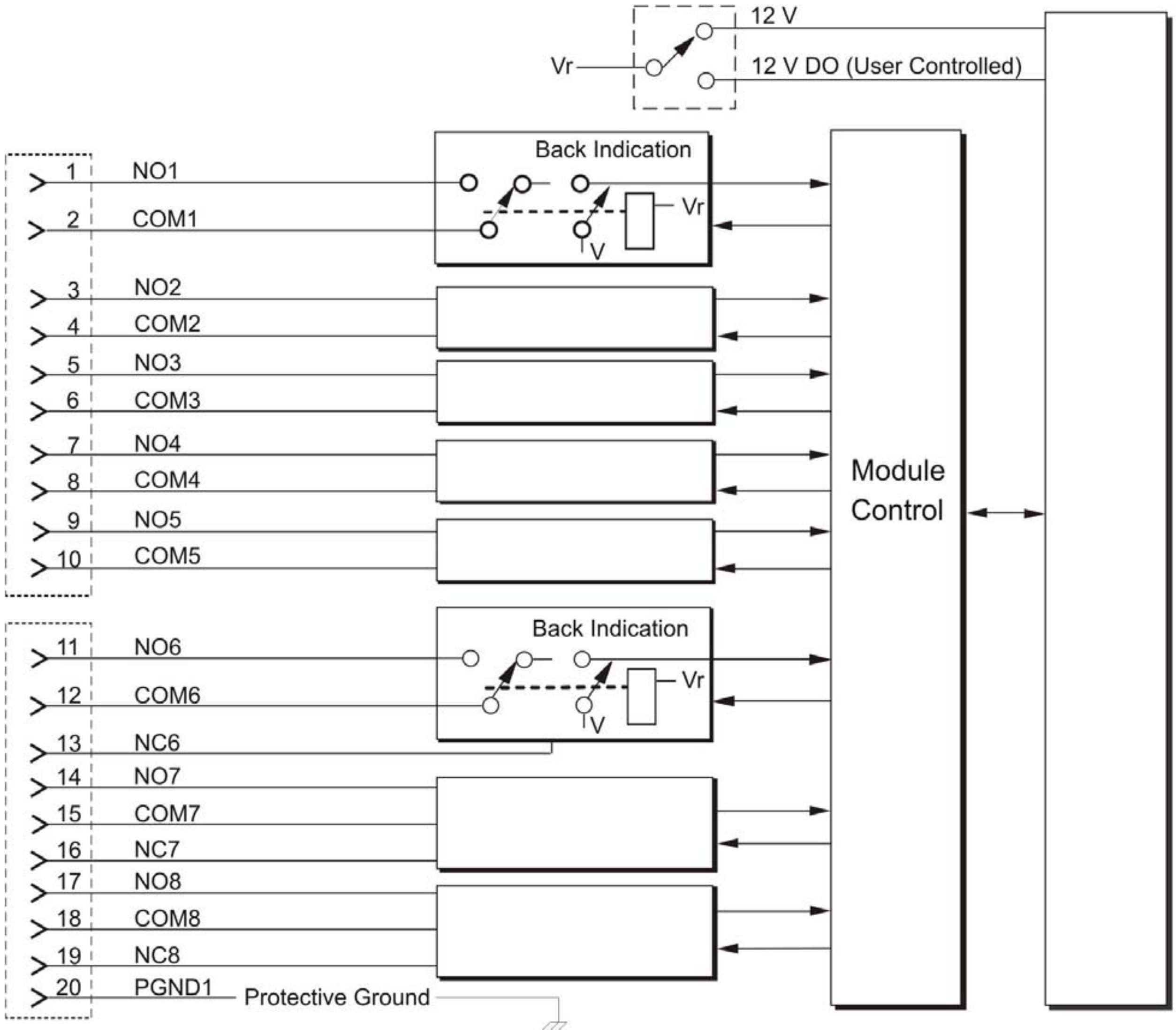


DO ML Relay (SPDT) - Typical Output Circuit

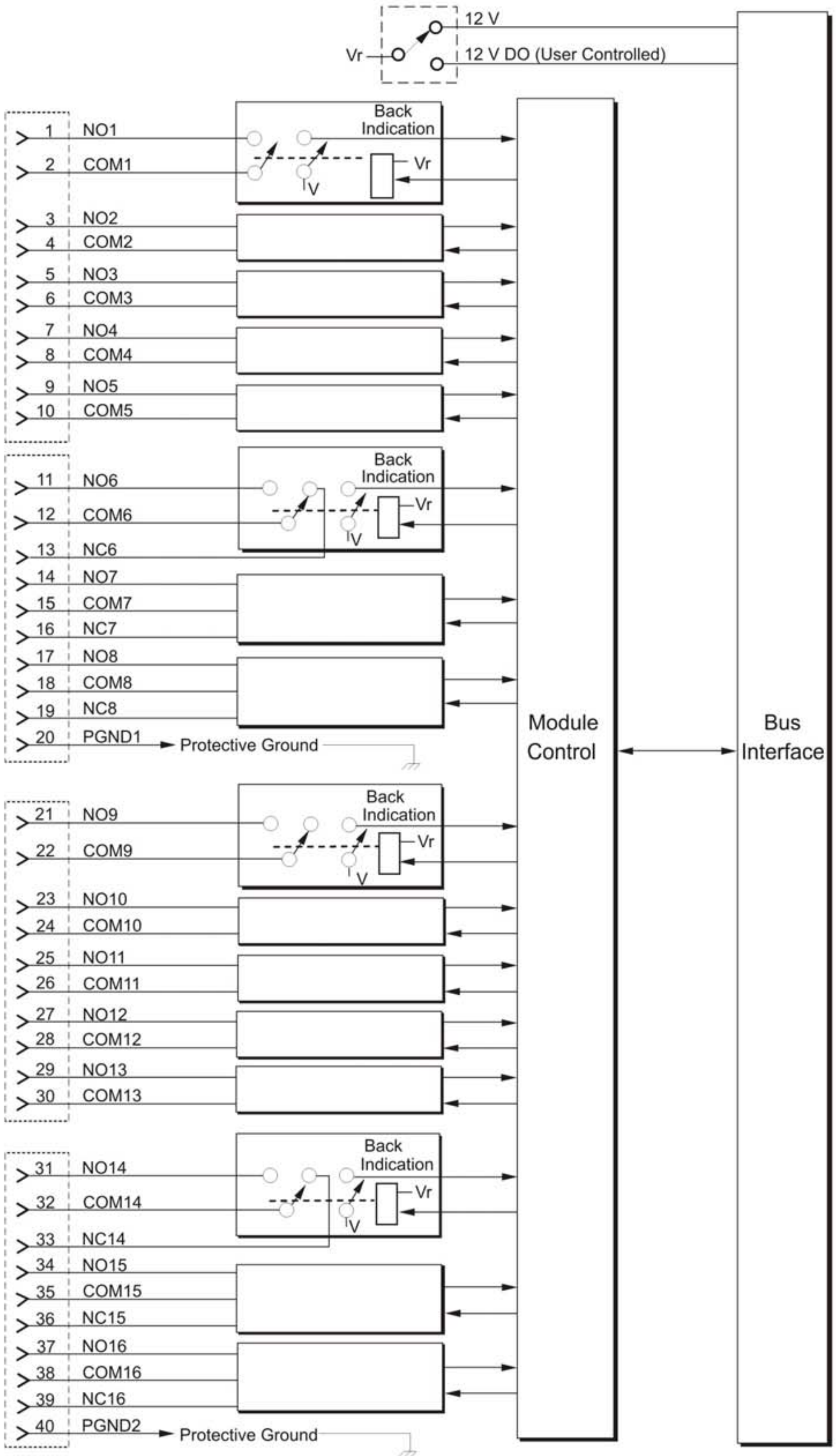


Module Block Diagram

8 DO



16 DO



12 V
Vr
12 V DO (User Controlled)
1 NO1
2 COM1
Back Indication
Vr
V
3 NO2
4 COM2
5 NO3
6 COM3
7 NO4
8 COM4
9 NO5
10 COM5
11 NO6
12 COM6
13 NC6
14 NO7
15 COM7
16 NC7
17 NO8
18 COM8
19 NC8
20 PGND1
Protective Ground
21 NO9
22 COM9
23 NO10
24 COM10
25 NO11
26 COM11
27 NO12
28 COM12
29 NO13
30 COM13
31 NO14
32 COM14
33 NC14
34 NO15
35 COM15
36 NC15
37 NO16
38 COM16
39 NC16
40 PGND2
Protective Ground
Module Control
Bus Interface

Connection Charts

8 DO

Pin	Function	Pin	Function
1	NO1	11	NO6
2	COM1	12	COM6
3	NO2	13	NC6
4	COM2	14	NO7
5	NO3	15	COM7
6	COM3	16	NC7
7	NO4	17	NO8
8	COM4	18	COM8
9	NO5	19	NC8
10	COM5	20	PGND1

16 DO

Pin	Function	Pin	Function
1	NO1	21	NO9
2	COM1	22	COM9
3	NO2	23	NO10
4	COM2	24	COM10
5	NO3	25	NO11
6	COM3	26	COM11
7	NO4	27	NO12
8	COM4	28	COM12
9	NO5	29	NO13
10	COM5	30	COM13
11	NO6	31	NO14
12	COM6	32	COM14
13	NC6	33	NC14
14	NO7	34	NO15
15	COM7	35	COM15
16	NC7	36	NC15
17	NO8	37	NO16
18	COM8	38	COM16
19	NC8	39	NC16
20	PGND1	40	PGND2

DO Relay Module Specifications

Total Number of Outputs	8 EE relay outputs 16 EE relay outputs 8 ML relay outputs 16 ML relay outputs
Output Arrangement	8 DO : 3 X Form C (SPDT) and 5 X Form A (SPST) 16 DO: 6 X Form C (SPDT) and 10 X Form A (SPST)
Contact Voltage Ratings	Max. 60 V DC or 30 V AC RMS (42.4 V peak).
Contact Power Ratings	2A @ 30 V DC, 0.6A @ 60V DC or 0.6A @ 30V AC (resistive load)
Relay Back Indication	Contact position - hardware back indication
DO Frequency	Max. 10 Hz
Diagnostic LEDs	LED per each output status, module error LED
User Connection	2 or 4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable and TB Holder	20 or 40 Wire Cable with Terminal Block Holder connector, 26 AWG
Fail State	Configurable relay state on CPU fail: On, Off or 'last value'
All Relays Disable/Enable	Selectable per module, controlled from the power supply
Module Replacement	Hot swap replacement – module extraction/insertion under voltage
Output Isolation	Between open contacts: 1kV, Between contact and coil: 1.5 kV, Between contact sets: 1.5 kV
Insulation	Insulation resistance 100 MΩ @ 500 V DC per IEC60255-5, Insulation impulse 1.5 kV per IEC60255-5
Operating Voltage	10.8-16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	8 DO : approx. 0.29 Kg (0.64 Lb) 16 DO: approx. 0.32 Kg (0.7 Lb)

Specifications subject to change without notice.

8 DIGITAL OUTPUT SBO RELAY MODULE

General Description

The 8 DO Select Before Operate (SBO) Relay modules have Electrically Energized (EE) 2 Form A relay outputs. The modules are supported by ACE3600 firmware v14.00 and above. The 8 DO SBO module is used to ensure that the correct DO has been selected before actually activating the relay.

Each DO in the module has two relays. When the module is in Idle state, the operate signal is disabled and no relay is activated. On “DO Select” command, both DO relays are selected. The select command is physically monitored by a back indication signal (“Check Select”.) After validation that only the requested relays were selected, the “Operate” command is set and enables the relay activation. The physical back indications from both relay contacts can be monitored by the application program to verify successful operation.

Note that only a single SBO DO can be selected at a time.

Each output has two types of back indications:

a. Back indication of the relay select command.

b. Back indication from the relay auxiliary contact (each relay has 2 contacts- one connected to user and the other as back indication.)

By default, the operation of the relays uses the 12V controlled source (controlled by the jumper on the main power supply.) If the 12V control in the main power supply is switched to OFF, there will be no activating voltage to the relays, regardless the status of the Operate signal.

For a description of the SBO feature, see Select Before Operate DOs in the ACE3600 I/Os chapter of the ACE3600 STS Advanced Features manual.

For a description of I/O module construction, location, LEDs, TBs, and other common I/O module features, see the I/O Modules chapter above.

Figure 11-1 provides a general view of the ACE3600 DO SBO Relay Module.

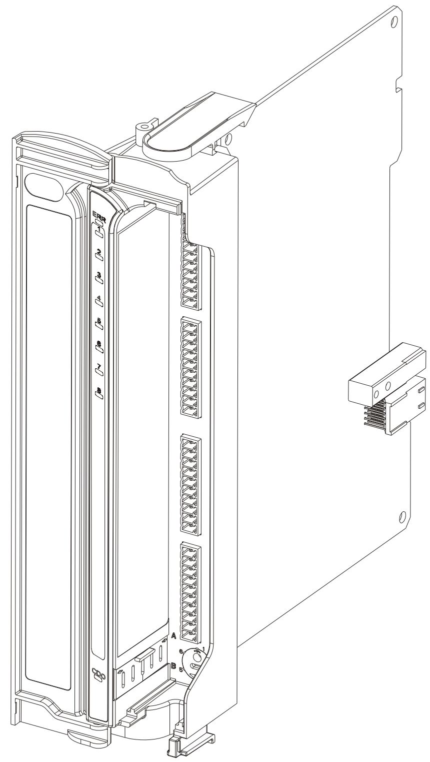


Figure 11-1 ACE3600 8DO SBO Relay Module – General View

Figure 11-2 provides a detailed view of the ACE3600 8DO SBO Relay Module front panel.

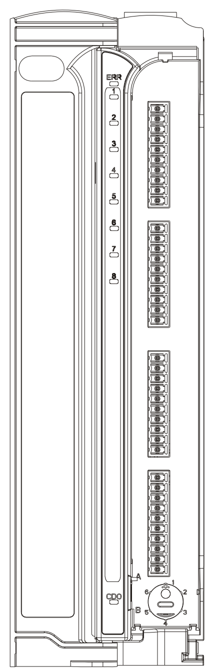


Figure 11-2 ACE3600 8DO SBO Relay Module – Front Panel

In the 8 DO SBO modules, the relays of the 8 outputs are Single Pole Single Throw (SPST) normally open (NO) and are referred to as the “Form A” relays.

In some applications, it is necessary to inhibit relay output operation when attending the site for safety reasons. In all DO relay modules, it is possible to inhibit all relays per DO module. When a module is configured to enable relay inhibiting (the default in the SBO module), the power to the relays is provided from the power supply via a dedicated power line (12V DO), controlled from the “12V DO” input (TB located on the power supply module panel). When the input’s terminals are shorted, the relays are operational. When the input’s terminals are open, the relays are inhibited (EE relays in the 0 position.)

Note: In systems with I/O expansion, the power supplies on I/O expansion frames can be attached via DC cable to the power supply on the previous I/O expansion frame in a daisy-chain manner, or directly to the main power supply. In this case, the 12V DO control on the main power supply can control all DO EE relays in the entire RTU that were configured by dip switch for 12V DO. This enables the user to inhibit all DO EE relays in the entire RTU simply by removing the plug from the 12V DO control in the main power supply. For more information, see the I/O Expansion and Expansion Power Supply Module chapters below.

The user program can monitor the relay inhibiting status and act accordingly. Also, when the module’s relays are inhibited, any mismatch between the relay position and the output logical state is ignored.

Module Configuration

Relay Inhibiting

NOTE

When the dip switch is set to 12V DO, the position of the 2-pin 12V DO Control connector on the front panel of the power supply module (see Power Supply Module chapter above) acts as a safety mechanism. When the 2-pin TB is unplugged from the 12V DO Control (e.g. for maintenance), power is not supplied via the motherboard to the relays and the relays are disabled. The 12V DO affects all relays in the system that are programmed to work from the 12V DO (the default in the SBO module) and not the 12V Main.

EE relays that are programmed for 12V DO operation will disconnect when 12V DO power is shut down and cannot be changed in this state.

The state of the Controlled DO LED (CDO) on the bottom of the front panel reflects the 12V control as follows:

a. OFF - 12V is not controlled.

b. ON - 12V is controlled and exists.

c. Blinking - 12V is controlled and does not exist.

A dual selector dip switch (S3) on the DO Relay module has 4 selectable positions as described in the following table:

Table 11-1 DO Relay Module- Dip Switch Settings

S3 SW 1	S3 SW 2	Configuration mode
OFF	OFF	12V – Relay inhibiting disabled
ON	OFF	Software selectable – inhibiting is set in site configuration
OFF	ON	12V – Relay inhibiting disabled
ON	ON	12V_DO – Relay inhibiting enabled (factory default)

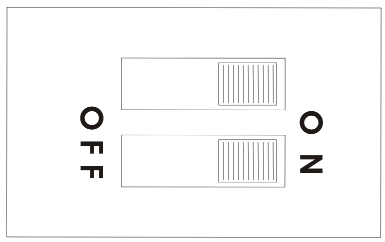


Figure 11-3 12V DO Dip Switch

When S3 is set to Software Selectable mode, the inhibiting configuration is set using the module configuration in the STS Site Configuration (see Table 11-2 below).

For instructions on setting the 12V DO dipswitch to enable relay inhibiting, see Procedure 9-1 in the Digital Output Relay Module chapter above.

DO Keep Last Value (KLV) and Predefined Value (PDV)

Each output can be configured to KLV or to a PDV (0, 1). This value is executed when the user program stops or when the module has no communication with the CPU module. Also, the PDV can be used during normal operation to force a value on the output by ignoring the user program value (mask).

Reset DO at Startup

Table 11-2 ACE3600 DO Relay Module Software Configurable Features

Parameter	Selection	Default Setup	Per Module/ Input	Parameter Setup Location

Parameter	Selection	Default Setup	Per Module/ Input	Parameter Setup Location
DO Keep Last Value & Pre Defined Value	KLV/PDV PDV = 0/1	PDV = 0	Output	Application Programmer I/O link table
DO Mask	No /Yes	No	Output	Application Programmer I/O link table
Relay Inhibiting (SW selectable)	12V DO (Enabled)/ 12V (Disabled)	12V DO (Enabled)	Module	Site configuration

Sleep Mode

Each DO module can be switched by the user program to Sleep Mode. In Sleep Mode, the module is not functioning and the power consumption is minimized.

Module Status and Diagnostics

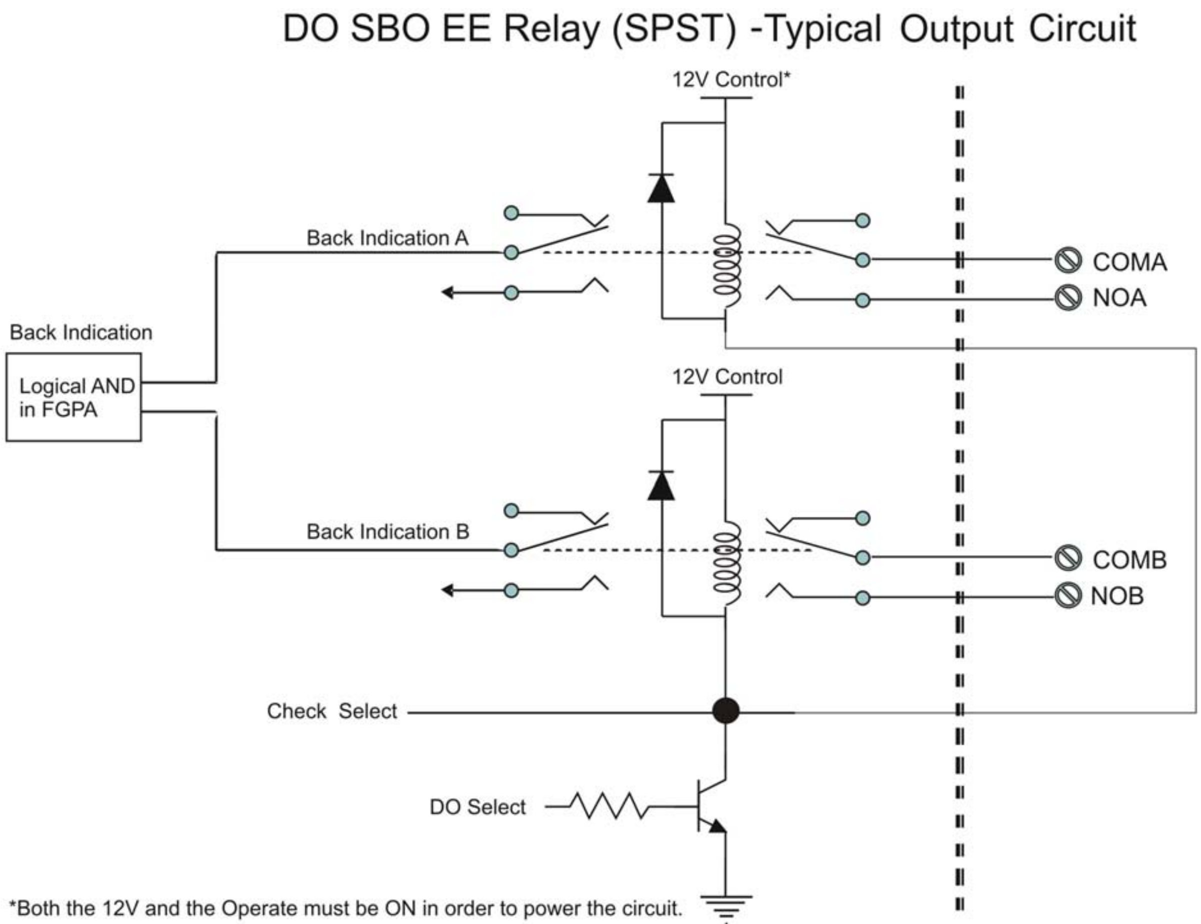
In the event of module failure, the module's ERR LED will be lit. This event is registered by the CPU in the Error Logger. Module failure status is also visible to the user program.

The DO module can be diagnosed and monitored using the STS Hardware Test utility. This test verifies that the module is operational, presents the module configuration and shows the actual value of each output. It is also possible to change the DO's value.

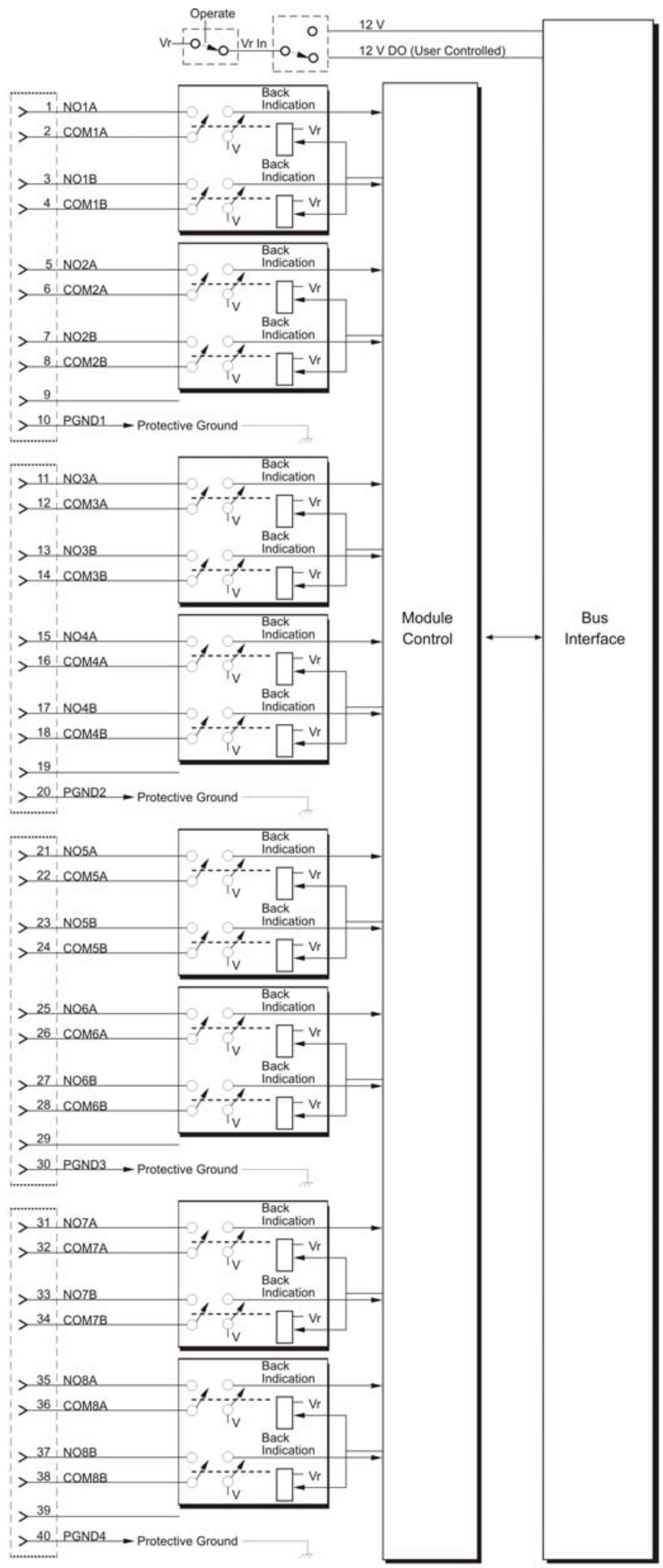
In the Hardware Test utility, it is possible to set the module to Freeze Mode. In this mode, the DOs will keep the last value they had at the time they were frozen. Freeze mode enables testing the inputs and outputs while the user program is running.

For details on configuring the DO modules, see the Configuring a Site section and the Application Programmer section of the ACE3600 STS User Guide.

I/O Circuit Diagram



Module Block Diagram



Connection Charts

8 DO SBO

Pin	Function	Pin	Function
1	NO1A	21	NO5A
2	COM1A	22	COM5A
3	NO1B	23	NO5B
4	COM1B	24	COM5B
5	NO2A	25	NO6A
6	COM2A	26	COM6A
7	NO2B	27	NO6B
8	COM2B	28	COM6B
9		29	
10	PGND	30	PGND
11	NO3A	31	NO7A
12	COM3A	32	COM7A
13	NO3B	33	NO7B
14	COM3B	34	COM7B
15	NO4A	35	NO8A
16	COM4A	36	COM8A
17	NO4B	37	NO8B
18	COM4B	38	COM8B
19		39	
20	PGND	40	PGND

8 DO SBO Relay Module Specifications

Total Number of Outputs	8 EE relay outputs
Output Arrangement	2 X Form A (SPST) - (two Normally Open contacts per DO)
Contact Voltage Ratings	Max. 60 V DC or 30 V AC RMS (42.4 V peak).
Contact Power Ratings	2A @ 30 V DC, 0.6A @ 60V DC or 0.6A @ 30V AC (resistive load)
Relay Back Indication	Contact Back Indication: Indicating Contact position
Relay Select Back Indication	Indicating relay selection before relay activation
DO Frequency	Max. 10 Hz
Diagnostic LEDs	LED per each output status, module error LED, Controlled DO LED Controlled DO LED states: a. OFF - 12V is not controlled. b. ON - 12V is controlled and exists. c. Blinking - 12V is controlled and does not exist.
User Connection	4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable and TB Holder	40 Wire Cable with Terminal Block Holder connector, 26 AWG
Fail State	Configurable relay state on CPU fail: On, Off or 'last value'
All Relays Disable/Enable	Selectable per module, controlled from the power supply
Module Replacement	Hot swap replacement – module extraction/insertion under voltage
Output Isolation	Between open contacts: 1kV, Between contact and coil: 1.5 kV, Between contact sets: 1.5 kV
Insulation	Insulation resistance 100 MΩ @ 500 V DC per IEC60255-5, Insulation impulse 1.5 kV per IEC60255-5
Operating Voltage	10.8-16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	Approx. 0.29 Kg (0.64 Lb)

Specifications subject to change without notice.

ANALOG INPUT MODULE

General Description

The Analog Input (AI) modules have 8 or 16 inputs. The modules sample and convert analog data into digital format and transfer the digital data to the CPU module.

The following modules are available:

- 8 AI ±20 mA (supports 4-20 mA)
- 16 AI ±20 mA (supports 4-20 mA)
- 8 AI ±5 V (supports 0-5 V and 1-5 V)
- 16 AI ±5 V (supports 0-5 V and 1-5 V)

The module's analog-to-digital conversion resolution is 16 bit (including sign). Each input is fully isolated from the other inputs on the module and also optically isolated from the module internal circuits. The modules are fully calibrated and can be tested and recalibrated in the field.

The measured values are digitally filtered to reduce the 50 or 60 Hz noise. The user can select the filtering frequency per module.

The measured values can be smoothed by digital filtering. Smoothing is accomplished by calculating the running average values of a defined number of converted analog values (samples). The user can select the level of smoothing per module. The higher the smoothing level chosen, the more stable is the smoothed analog value and the longer it takes until the smoothed analog signal is applied after a step response.

The user can select how the analog values are represented to the user application program as unit-less numeric values or as scaled values that represent certain Engineering Units (EGU).

Each AI module can include an optional plug-in floating 24V DC power supply to power external devices.

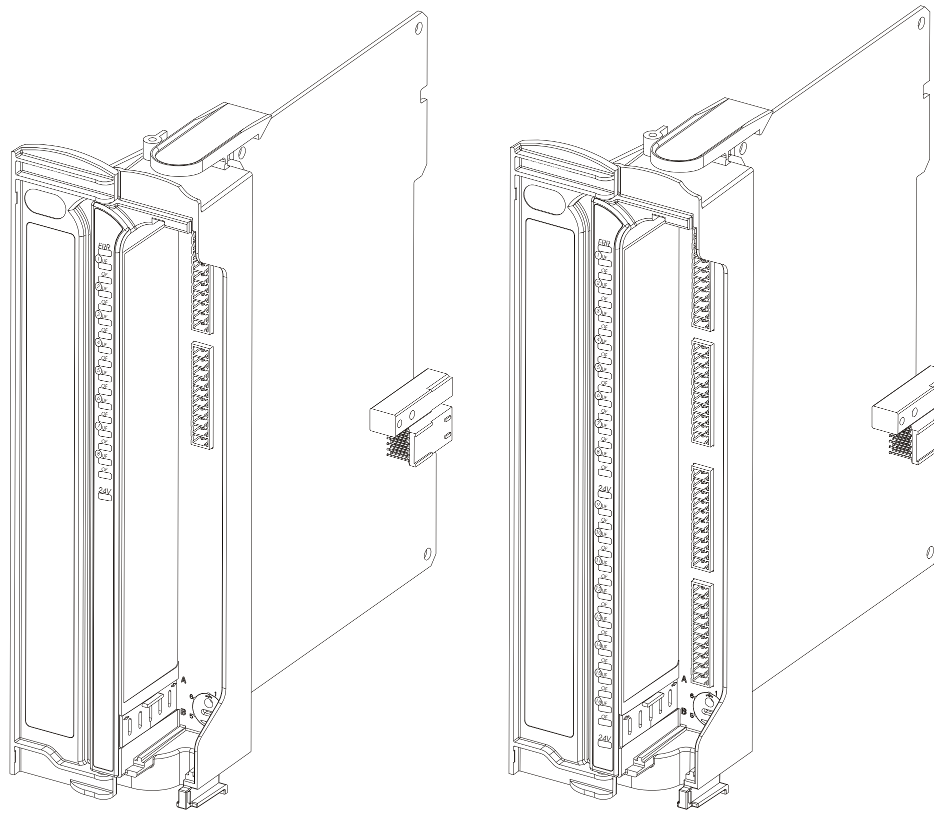
Each analog input has two status LEDs:

- UF - indicates Underflow when lit
- OF - indicates Overflow when lit

For a description of I/O module construction, location, LEDs, TB holder, and other common I/O module features, see the I/O Modules chapter above.

For details on specific AI parameters and configuration, see AI Module Configuration below.

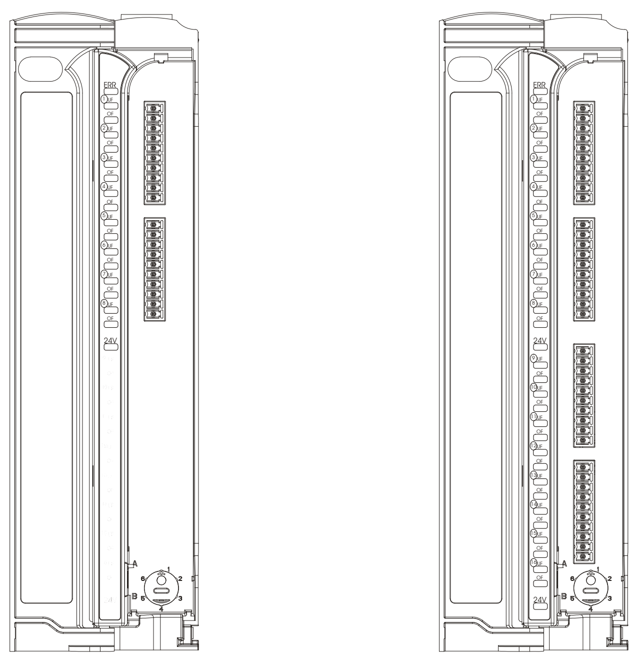
Figure 12-1 provides a general view of the ACE3600 AI module.



8 AI Module **16 AI Module**

Figure 12-1 ACE3600 AI Module – General View

Figure 12-2 provides a detailed view of the AI module front panel.



8 AI Module **16 AI Module**

Figure 12-2 ACE3600 AI Module – Front Panel

AI Module Configuration

50/60 Hz Filtering

This parameter enables the user to configure the module to use 50 or 60 Hz filter on all inputs.

AI Filter (Smoothing)

This parameter enables the user to configure the level smoothing (averaging) on all inputs. It can be set to 1, 2, 4, 8, 16, 32, 64,128 samples.

Change Of State (COS) Delta

This parameter sets a delta value to each input. This enables the user application program to get an indication when the input value change is more than ± delta value.

Input Range

This parameter sets the overflow and underflow limits (refer to AI Module value representation below.)

In the current input modules, the ranges that can be selected are: ±20 mA (default) and 4-20 mA.

In voltage input modules, the ranges that can be selected are ± 5V (default), 0-5 V and 1-5 V.

Keep Last Value (KLV) and Predefined Value (PDV)

Each input can be configured to KLV or to a PDV. This value is shown to the user application program in the event of AI module failure. The predefined value can also be used during normal operation to force a value that masks the actual input value. In this case the user application program will get the PDV instead of the actual input value.

I/O Legacy Resolution Parameter

In systems with both ACE3600 RTUs and legacy (MOSCAD/MOSCAD-L) RTUs, some MOSCAD/MOSCAD-L applications can be upgraded to ACE3600 without modifying the references to analog values in the applications ('C' or ladder). The I/O Legacy Resolution STS advanced parameter sets the Analog I/O bit resolution to either Actual (ACE3600) or Legacy (MOSCAD/MOSCAD-L).

For values and restrictions, see Appendix A: Site Configuration Parameters in the ACE3600 STS User Guide.

AI Module Configuration Options

The AI module features which can be configured are listed in the table below. Some parameters are per module and some are per input.

Table 12-1 ACE3600 AI Module Configurable Parameters

Parameter	Selection	Default setup	Per Module / Input	Parameter Setup location
50/60 Hz Filtering	50/60	50 Hz	Module	STS Site configuration
AI Filter (Smoothing)	1/2/4/8/16/32/64/128 (x10 mS)	32	Module	STS Site configuration
Input Range	Current: ±20 mA/ 4-20 mA Voltage: ±5 V/0-5V/ 1-5V	Current: ±20 mA Voltage: ±5 V	Module	STS Site configuration
COS Delta	value	0 (disabled)	Input	Application Programmer I/O link table
KLV & PDV	KLV/PDV PDV=value	KLV	Input	Application Programmer I/O link table
Mask	No /Yes	No	Input	Application Programmer I/O link table

Sleep Mode

Each AI module can be switched by the user application program to Sleep Mode. In Sleep Mode, the module does not function and the power consumption is minimized. During Sleep mode the user application program will get the predefined values for each I/O.

Module Status and Diagnostics

In the event of AI Module failure, the I/O module ERR LED will be lit. The event is registered by the CPU in the Error Logger. AI Module failure status is also visible to the user application program.

In addition to the ERR LED, the module includes an Underflow (UDF) and Overflow (OVF) LED for each input.

• When the UDF LED is lit, it indicates that the signal level in the corresponding input is below the nominal range.

• When the OVF LED is lit, this indicates that the signal level in the corresponding AI is above the nominal range.

• If both the UDF and OVF LEDs of the same channel are lit, the channel is uncalibrated.

The AI module can be diagnosed and monitored using the STS Hardware Test utility. The Hardware Test verifies that the module is operational, presents the module configuration and shows the actual value of each input, including overflow and underflow. It is also possible to change the input filter setup for the duration of the Hardware test.

In the HW Test utility, it is possible to set the AI module to Freeze Mode. In this mode the program user will get the KLV or PDV of each input in the module instead of the actual input value. Freeze mode enables testing the inputs while the user application program is running.

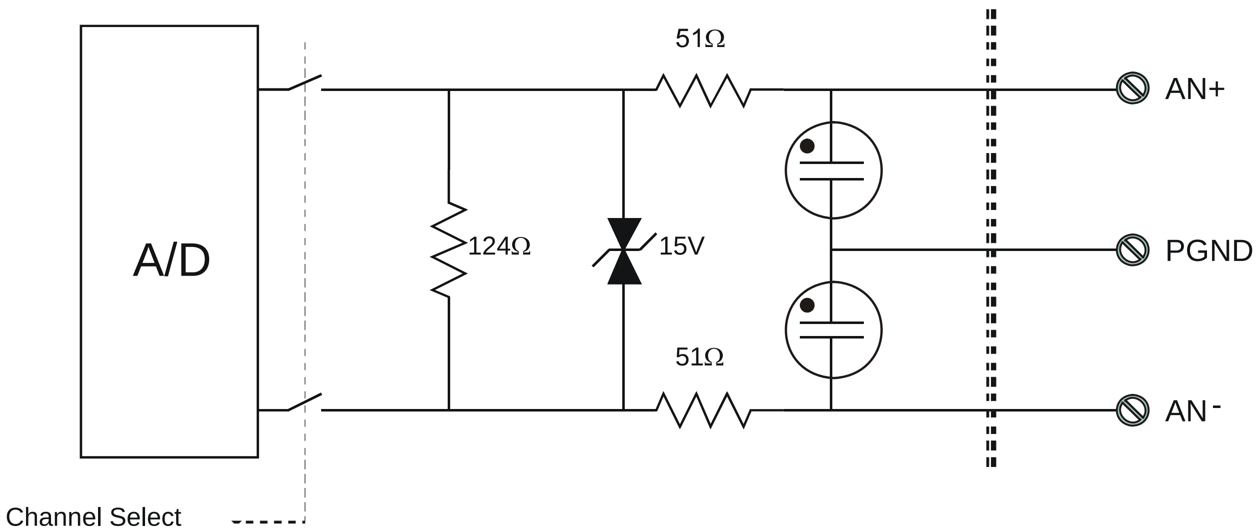
AI Module Value Representation

In ± 20 mA current inputs	Decimal Value	Input Current	Indication
	< -32256	< -20.16 mA	Underflow LED ON
	-32000	-20 mA	Rated range (no LED active)
	0	0 mA	
	32000	+20 mA	
	> 32256	> +20.16 mA	Overflow LED ON
In 4 - 20 mA current inputs	**Decimal Value**	**Input Current**	**Indication**
	< 6144	< 3.84 mA	Underflow LED ON
	6400	+4 mA	Rated range (no LED active)
	0	0 mA	
	32000	+20 mA	
	> 32256	> +20.16 mA	Overflow LED ON
In ± 5 V current inputs	**Decimal Value**	**Input Voltage**	**Indication**
	< -32256	<-5.04V	Underflow LED ON
	-32000	-5 V	Rated range (no LED active)
	0	0 V	
	32000	+5 V	
	> 32256	> +5.04 V	Overflow LED ON
In 0 - 5 V current inputs	**Decimal Value**	**Input Voltage**	**Indication**
	< -256	< -0.04 V	Underflow LED ON
	0	0 V	Rated range (no LED active)
	32000	+5 V	
	> 32256	> +5.04 V	Overflow LED ON

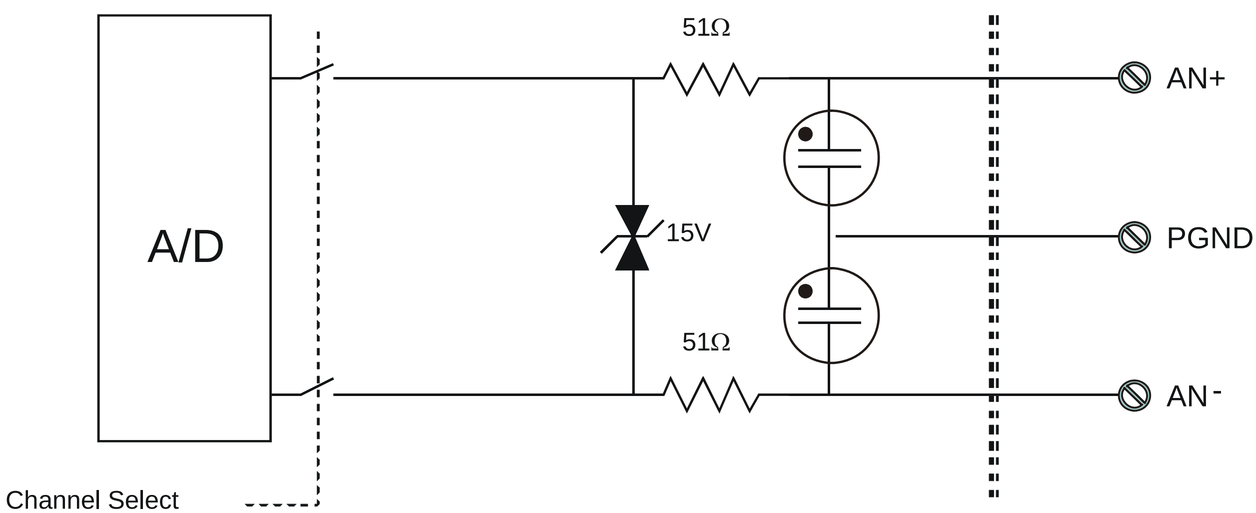
In 1 - 5 V current inputs	Decimal Value	Input Voltage	Indication
	< 6144	< 0.96 V	Underflow LED ON
	6400	1 V	Rated range (no LED active)
	32000	+5 V	
	> 32256	> 5.04 V	Overflow LED ON

I/O Circuit Diagram

AI ±20 mA - Typical Input Circuit

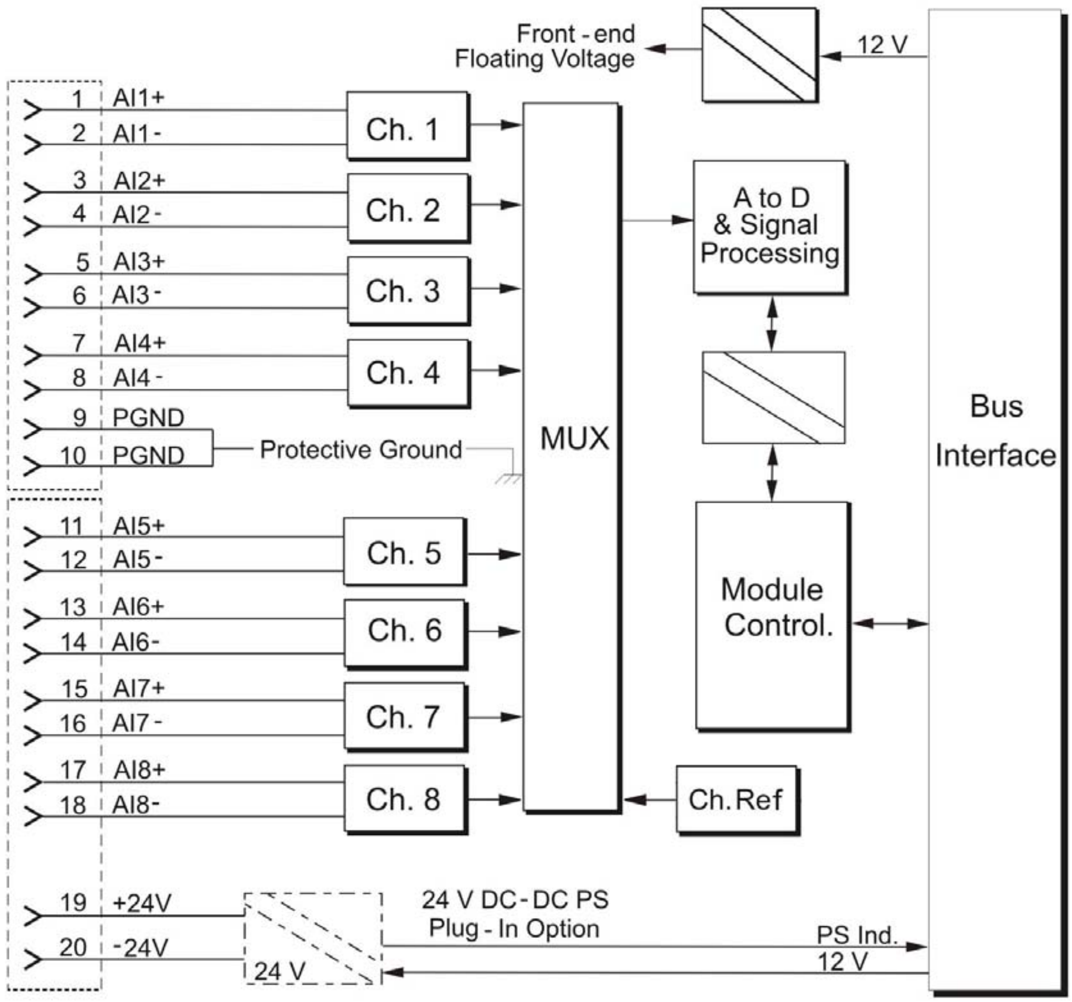


AI ±10 V - Typical Input Circuit

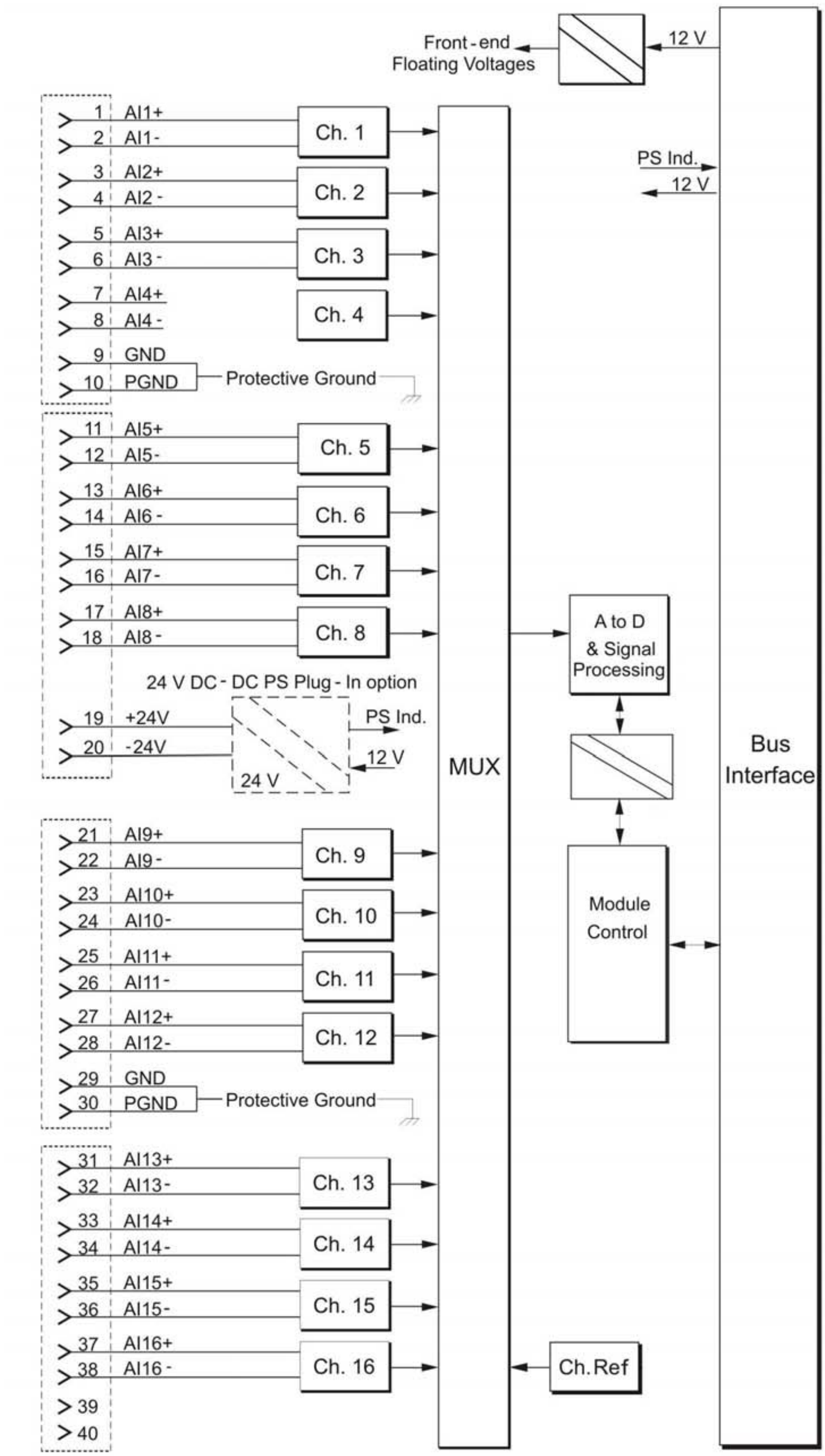


Module Block Diagram

8 AI



16 AI



Front-end Floating Voltages
12 V
1 AI1+
2 AI1-
3 AI2+
4 AI2-
5 AI3+
6 AI3-
7 AI4+
8 AI4-
9 GND
10 PGND
Protective Ground
11 AI5+
12 AI5-
13 AI6+
14 AI6-
15 AI7+
16 AI7-
17 AI8+
18 AI8-
24 V DC - DC PS Plug - In option
19 +24V
20 -24V
PS Ind.
12 V
24 V
21 AI9+
22 AI9-
23 AI10+
24 AI10-
25 AI11+
26 AI11-
27 AI12+
28 AI12-
29 GND
30 PGND
Protective Ground
31 AI13+
32 AI13-
33 AI14+
34 AI14-
35 AI15+
36 AI15-
37 AI16+
38 AI16-
39
40
Ch. 1
Ch. 2
Ch. 3
Ch. 4
Ch. 5
Ch. 6
Ch. 7
Ch. 8
Ch. 9
Ch. 10
Ch. 11
Ch. 12
Ch. 13
Ch. 14
Ch. 15
Ch. 16
MUX
A to D & Signal Processing
Module Control
Ch.Ref
PS Ind.
12 V
Bus Interface

Connection Charts

8 AI

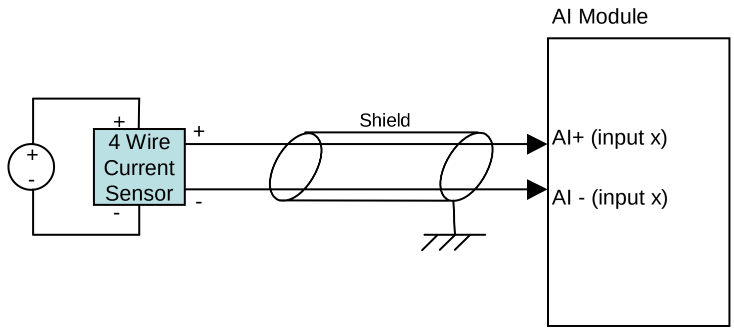
Pin	Function	Pin	Function
1	AI1+	11	AI5+
2	AI1-	12	AI5-
3	AI2+	13	AI6+
4	AI2-	14	AI6-
5	AI3+	15	AI7+
6	AI3-	16	AI7-
7	AI4+	17	AI8+
8	AI4-	18	AI8-
9	PGND	19	+24V
10	PGND	20	-24V

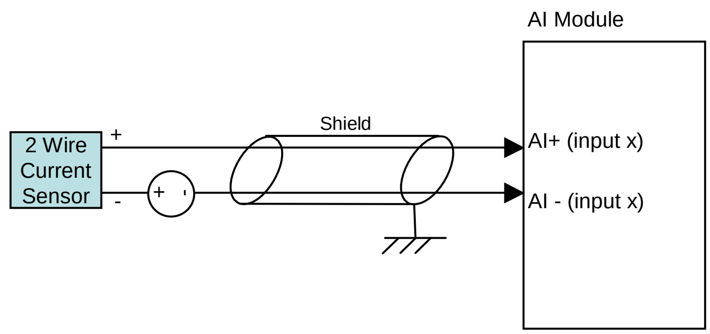
16 AI

Pin	Function	Pin	Function
1	AI1+	21	AI9+
2	AI1-	22	AI9-
3	AI2+	23	AI10+
4	AI2-	24	AI10-
5	AI3+	25	AI11+
6	AI3-	26	AI11-
7	AI4+	27	AI12+
8	AI4-	28	AI12-
9	PGND	29	GND
10	PGND	30	PGND
11	AI5+	31	AI13+
12	AI5-	32	AI13-
13	AI6+	33	AI14+
14	AI6-	34	AI14-
15	AI7+	35	AI15+
16	AI7-	36	AI15-
17	AI8+	37	AI16+
18	AI8-	38	AI16-
19	+24V	39	
20	-24V	40	

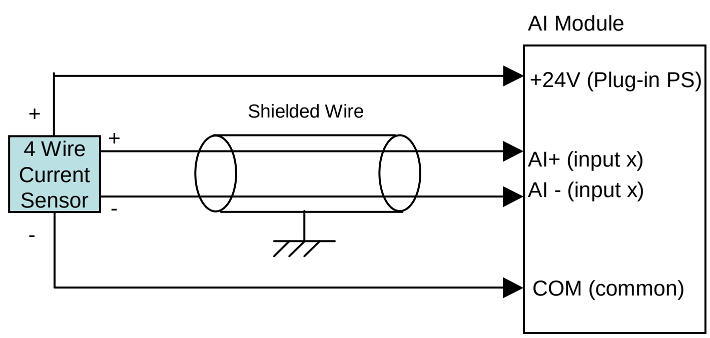
I/O Connection Diagram

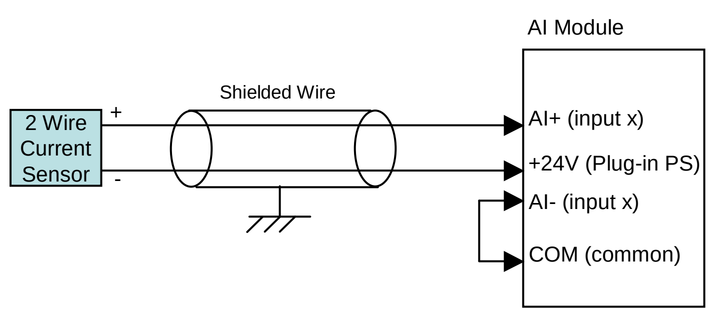
The diagram below describes the connection of two-wire and four-wire current sensors/transmitters to the Analog Input module.





The diagram below describes the connection of two-wire and four-wire current sensors using the 24V PS plug-in on the Analog Input module.





AI Module Specifications

Total Number of Inputs	8 AI ±20 mA (4-20 mA) 16 AI ±20 mA (4-20 mA) 8 AI ±5 V (0-5 V, 1-5 V) 16 AI ±5 V (0-5 V, 1-5 V)
Input Configuration	Isolated (floating) analog inputs
A to D Resolution	16 bit (including sign)
Input Accuracy	±0.1% of full scale @ -40ºC to +70ºC
Input Sampling Time	10 mSec @ 50 Hz filtering; 8.33 mSec @ 60 Hz filtering
Smoothing	Selectable input averaging:1,2,4,8,16,32,64,128 samples (x10 mS)
Permitted Potential Between Inputs	75 V DC, 60 V AC (RMS)
Input Impedance	±20 mA input: Rin < 250 Ω ±5 V input: Rin > 1 MΩ
Crosstalk Rejection	Better than 80 dB between any pair of inputs
Temperature Stability	25 PPM/ºC
Interference Suppression	Selectable 50 or 60 Hz filtering, Common mode rejection > 100 dB, Differential mode rejection > 50 dB
24 V DC Output	Supports optional isolated 24V Plug-in Power Supply (one in 8 DI, two in 16 DI)
Diagnostic LEDs	Overflow and Underflow LED per each input status, Module error LED, 24V Plug-in status LED The module Overflow and Underflow levels can be configured to: Current inputs: ±20mA / 4-20 mA Voltage inputs: ±5 V / 0-5 V /1-5 V
User Connection	2 or 4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable and TB Holder	20 or 40 Wire Cable with TB Holder connector, 26 AWG
Module Replacement	Hot swap replacement– module extraction/insertion under voltage
Input Isolation	1.5 kV RMS between input and module logic, per IEC60255-5
Input Insulation	Insulation resistance 100 MΩ @ 500 V DC, per IEC60255-5
Operating Voltage	10.8-16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Dimensions	37 mm W x 225 mm H x 180 mm D, (1.5" W x 8.7" H x 7.1" D)
Weight	8 AI : approx.032 Kg (0.71 Lb) 16 AI: approx. 0.34 Kg (0.75 Lb)

Specifications subject to change without notice.

ANALOG OUTPUT MODULE

General Description

The Analog Output (AO) modules have four optically-isolated analog output channels for controlling user devices (see Figure 13-1). Each channel has two possible outputs: 0-20 mA Interface industry standard current output and 0-10 V Interface industry standard voltage output. Only one of the outputs can be enabled in a particular channel - either current or voltage.

The module's digital to analog converter resolution is 14 bit. The Analog Output channels are optically isolated from the module internal logic circuits. The modules are fully calibrated and can be tested and recalibrated in the field.

Each analog output has three status LEDs, Vout, Iout, and CAL which represent the calibration status of each output for voltage/current. See Module Status and Diagnostics below for the LEDs behavior.

For a description of I/O module construction, location, LEDs, TBs, and other common I/O module features, see the I/O Modules chapter above.

For details on specific AO parameters and configuration, see AO Module Configuration below.

Figure 13-1 provides a general view of the ACE3600 AO module.

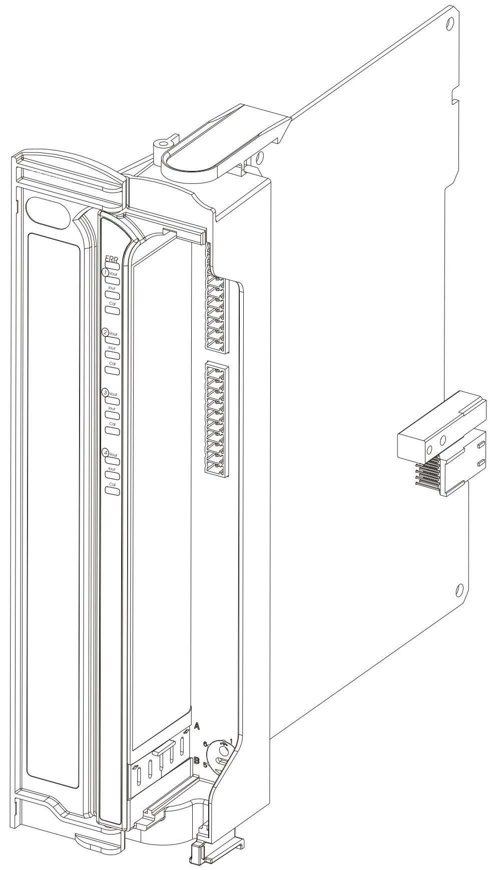


Figure 13-1 ACE3600 AO Module – General View

Figure 13-2 provides a detailed view of the AO module front panel.

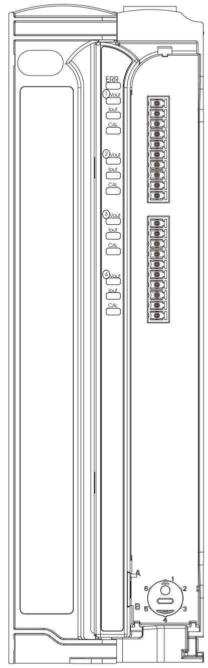


Figure 13-2 ACE3600 AO Module – Front Panel

AO Module Configuration

AO Type

The analog outputs can be set to voltage, current, or raw data. See Module Status and Diagnostics for details.

AO Value

The analog outputs can be set to a numeric value (in the range of 0 to 16000) or either in voltage or current according to the output type. The values for voltage are 0 to 10 V and the values for current are 0 to 20 mA. See Module Status and Diagnostics for details.

The AO module value representation is as follows:

In 0-20 mA current outputs	Decimal Value	Output Current
	0	0
	4000	5 mA
	8000	10 mA
	16000	20 mA
In 0- 10 V voltage outputs	**Decimal Value**	**Output Voltage**
	0	0 V
	4000	2.5 V
	8000	5 V
	16000	10 V

AO Calibration

The upper and lower limits of analog outputs can be calibrated - either as current (20mA upper limit and 4mA lower limit) or voltage (10V upper limit and 2V lower limit). Default upper and lower calibration limits are provided from the factory. See Module Status and Diagnostics for details.

Keep Last Value (KLV) and Predefined Value (PDV)

Each output can be configured to KLV or to a PDV. This value is maintained in the event of AO module failure or communication failure with the CPU.

The predefined value can also be used during normal operation to force a value that masks the actual output value.

I/O Legacy Resolution Parameter

In systems with both ACE3600 RTUs and legacy (MOSCAD/MOSCAD-L) RTUs, some MOSCAD/MOSCAD-L applications can be upgraded to ACE3600 without modifying the references to analog values in the applications (‘C’ or ladder). The I/O Legacy Resolution STS advanced parameter sets the Analog I/O bit resolution to either Actual (ACE3600) or Legacy (MOSCAD/MOSCAD-L).

For values and restrictions, see Appendix A: Site Configuration Parameters in the ACE3600 STS User Guide.

AO Module Configuration Options

The AO module features which can be configured are listed in the table below. Some parameters are per module and some are per output.

Table 13-1 ACE3600 AO Module Configurable Parameters

Parameter	Selection	Default setup	Per Module / Output	Parameter Setup location
AO Type	Voltage/Current	User Defined	Output	STS HW Test/User application program
AO Value	Voltage - 0 to 10 V Current - 0 to 20 mA	User Defined	Output	STS HW Test/User application program
AO Calibration	Voltage - 2 to 10 V Current - 4 to 20 mA	Voltage - 2 to 10 V Current - 4 to 20 mA	Output	STS HW Test
KLV & PDV	KLV/PDV PDV=value	KLV	Output	Application Programmer I/O link table
Mask	No /Yes	No	Output	Application Programmer I/O link table

Sleep Mode

Each AO module can be switched by the user application program to Sleep Mode. In Sleep Mode, the module does not function and the power consumption is minimized. During Sleep mode the user application program will get the predefined values for each output.

Module Status and Diagnostics

In the event of AO Module failure, the I/O module ERR LED will be lit. The event is registered by the CPU in the Error Logger. AO Module failure status is also visible to the user application program.

In addition to the ERR LED, the module includes a voltage output (Vout), current output (Iout), and calibration (CAL) LED for each output.

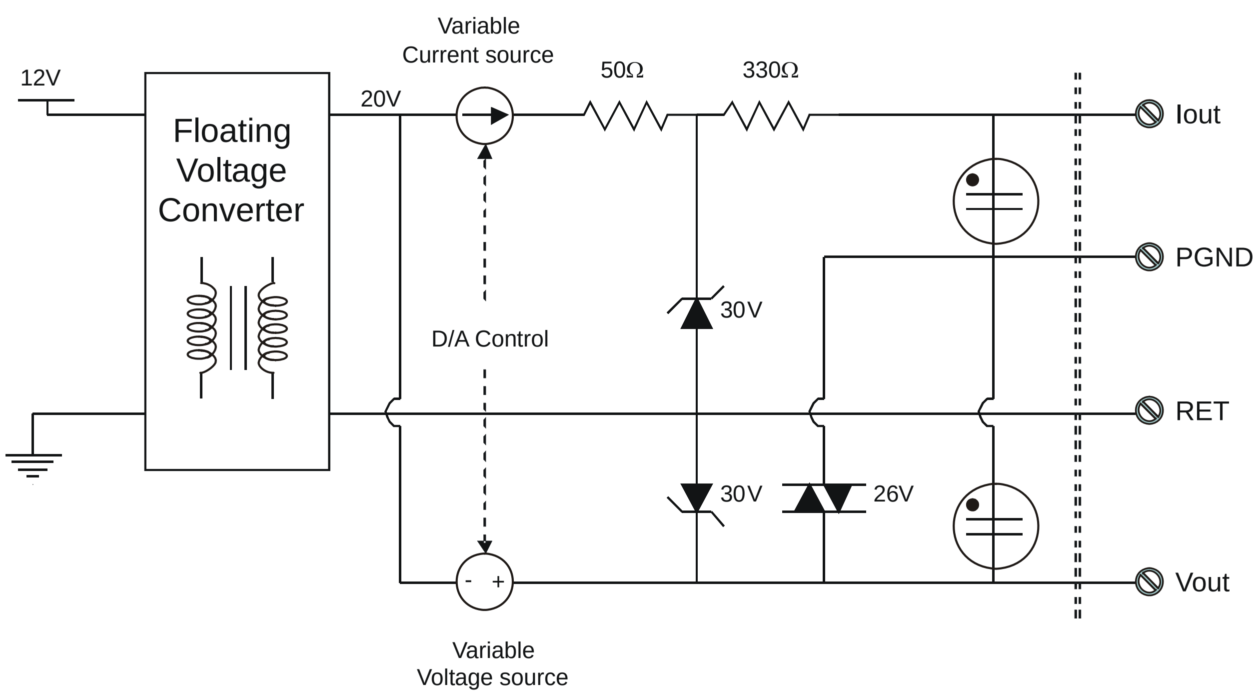
CAL	Vout	Iout	Indication
On	On	On	Neither output is calibrated.
On	Off	On	Iout is uncalibrated.
On	On	Off	Vout is uncalibrated.
Off	On	On	Row value for testing purpose is defined by the user, either using HW test or user application program to send raw data.
Off	On	Off	Vout is defined by the user, either using HW test or user application program.
Off	Off	On	Iout is defined by the user, either using HW test or user application program.

The AO module can be diagnosed and monitored using the STS Hardware Test utility. The Hardware Test verifies that the module is operational, shows the type and actual value of each output, enables calibration, and presents the ROM data calibration factors. The AO type can be set either in the user application program or in the Hardware Test. To set the output value in the Hardware test, the user application program must be stopped or the AO module frozen. To calibrate the output in the Hardware test, the user application program must be stopped or the AO module frozen.

In the Hardware Test utility, it is possible to set the AO module to Freeze Mode. In this mode, the AOs will keep the last value they had at the time they were frozen. Freeze mode enables testing the inputs and outputs while the user program is running.

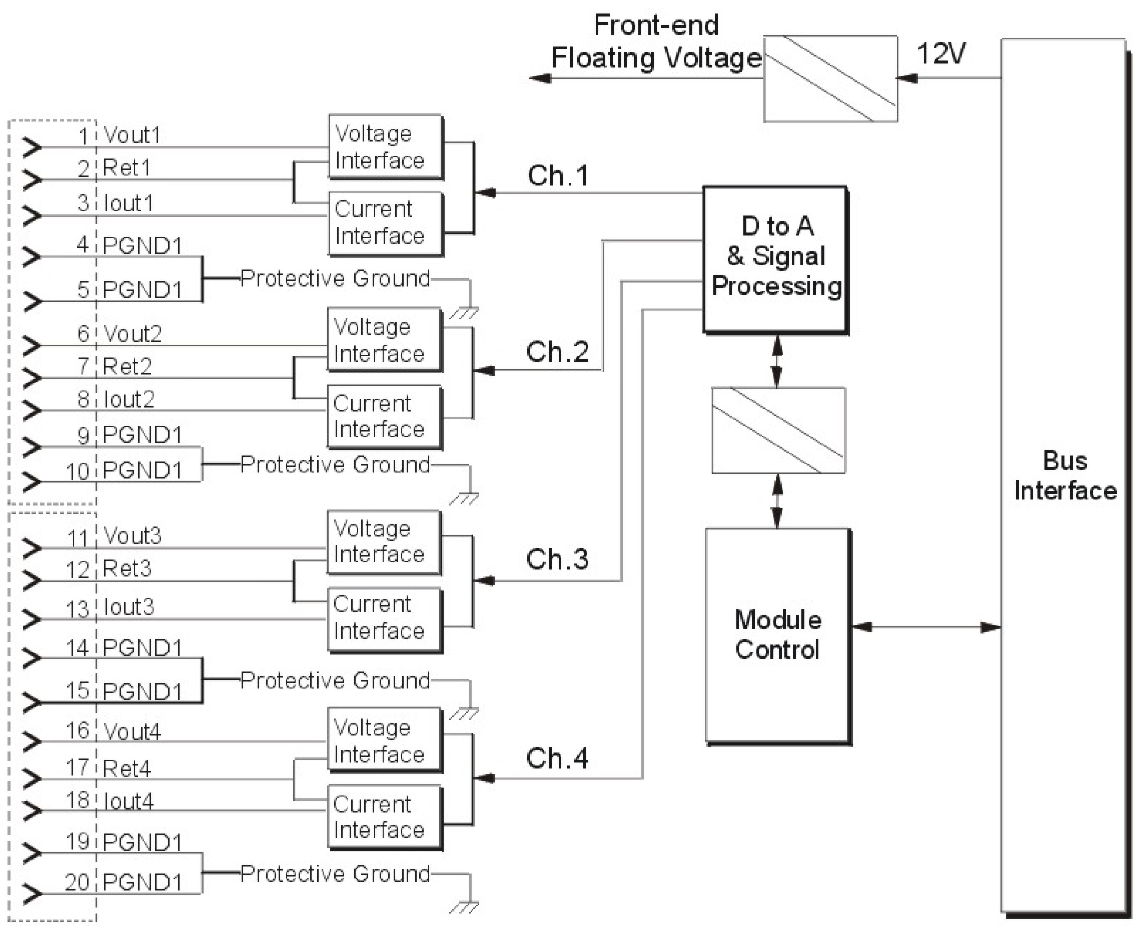
I/O Circuit Diagram

AO - Typical Output Circuit



Module Block Diagram

4 AO

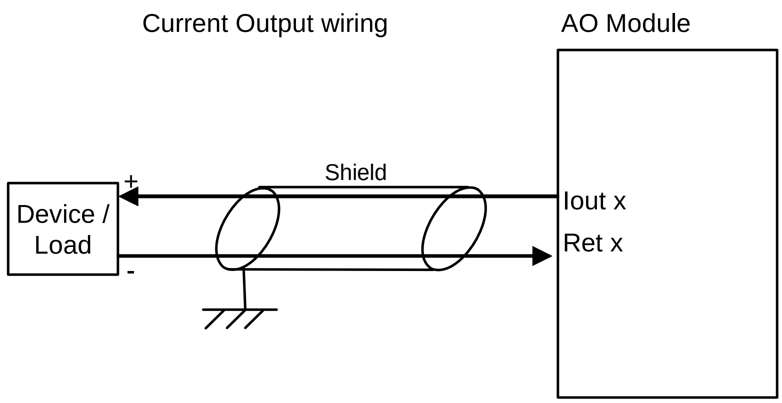


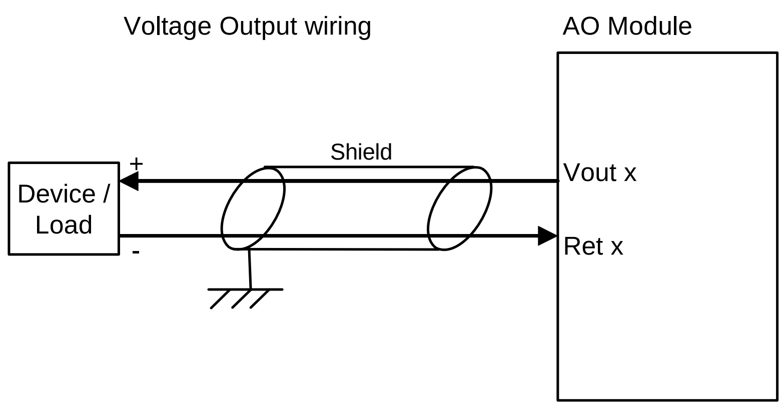
Connection Charts

4 AO

Pin	Function	Pin	Function
1	Vout1	11	Vout3
2	Ret1	12	Ret3
3	Iout1	13	Iout3
4	PGND1	14	PGND1
5	PGND1	15	PGND1
6	Vout2	16	Vout4
7	Ret2	17	Ret4
8	Iout2	18	Iout4
9	PGND1	19	PGND1
10	PGND1	20	PGND1

I/O Connection Diagram





AO Module Specifications

Total Number of Outputs	4 AO current (0-20 mA) or voltage (0-10 V)
Output Arrangement	Isolated floating channels, each channel can be connected as 0-20 mA or 0-10 V DC voltage
D to A Resolution	14 bit
Output Accuracy	±0.1% full scale @ 25ºC
Temperature Stability	25 PPM/ºC
Internal Settling Time	Max. 1.0 msec
Output Load	Voltage: > 1.0 kΩ, < 1.0 µf Current: < 750 Ω (internal power source)
Crosstalk Rejection	Better than 50 dB between any pair of outputs
Interference Suppression	Common mode rejection > 60 dB
Output Protection	Voltage output: short circuit current, max. 30 mA Current output: No-load voltage max. 22 V DC
Diagnostic LEDs	Module error LED, Voltage mode LED, Current mode LED, Calibration LED per channel
User Connection	2 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable and TB Holder	20 Wire Cable with TB Holder connector, 26 AWG
Module Replacement	Hot swap replacement– module extraction/insertion under voltage
Isolation	1.5 kV between output and module logic
Insulation	Insulation resistance 100 MΩ @ 500 V DC, per IEC60255-5
Operating Voltage	10.8-16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Dimensions	37 mm W x 225 mm H x 180 mm D, (1.5" W x 8.7" H x 7.1" D)
Weight	Approx. 0.29 Kg (0.64 Lb)

Specifications subject to change without notice.

MIXED I/O MODULE

General Description

The ACE3600 Mixed I/O modules include a mixture of Digital Inputs, Relay Outputs and Analog Inputs on the same module.

The available Mixed I/O modules are:

- 16 Digital Inputs + 4 EE DO Relay Outputs + 4 Analog Inputs (±20 mA)
- 16 Digital Inputs + 4 ML DO Relay Outputs + 4 Analog Inputs (±20 mA)

Figure 14-1 provides a general view of the ACE3600 Mixed I/O module.

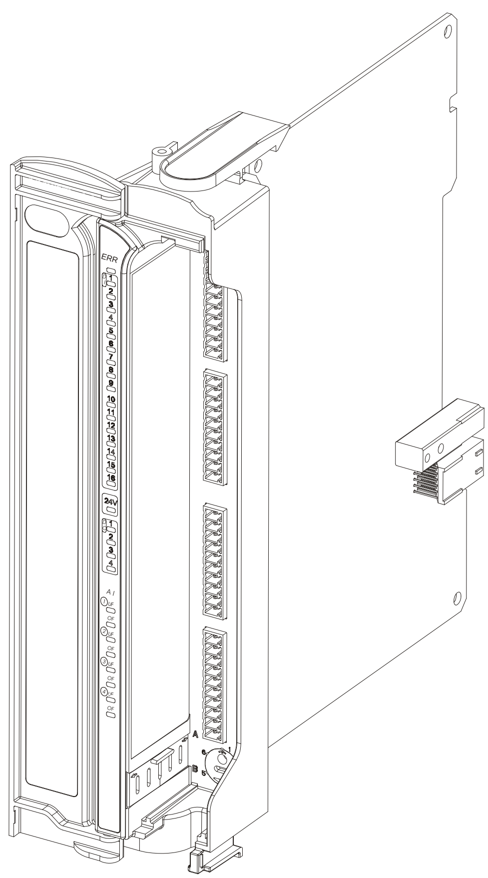


Figure 14-1 ACE3600 Mixed I/O Module – General View

Another type of mixed I/O is found on the Digital Output/Digital Input (DO/DI) FET module. See the Digital Output/Digital Input (DO/DI) FET module chapter above for more information.

Figure 14-2 provides a detailed view of the Mixed I/O module front panel.

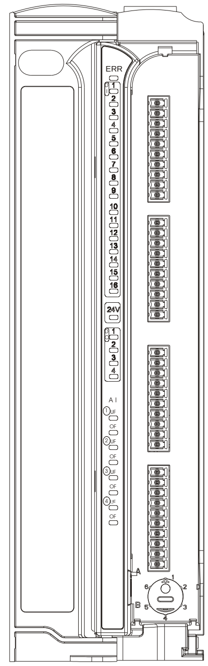


Figure 14-2 ACE3600 Mixed I/O Module – Front Panel

The Digital Input (DIs) on the Mixed I/O modules are voltage ("wet") inputs IEC 61131-2 Type II compliant. The first 12 DIs can function as fast counters. All DIs are optically isolated.

Each DI can be an event trigger (by interrupt) to a high priority fast process. A high priority fast process enables very fast activation of an output in response to an input trigger and logical conditions. This high priority fast process is independent of the I/O scan (refer to the STS Application Programmer manual).

All four relay outputs are Single Pole Double Throw (SPDT) and are referred to as the "Form C" relays. The physical position of each relay is monitored by the module logic, by using a back indication signal which is connected to the relay's second contact set. Any contradiction between the required position and the back indication signal, is reported to the CPU and is available to the user application program.

In some applications, it is necessary to inhibit relay output operation when attending the site for safety reasons. In all DO relay modules; it is possible to inhibit all relays per DO module. When a module is configured to enable relay inhibiting, the power to the relays is provided from the power supply via a dedicated power line (12V DO), controlled from the "12V DO" input (TB located on the power supply module panel). When the input's terminals are shorted, the relays are operational. When the input's terminals are open, the relays are inhibited (EE relays in the OFF (0) position and ML relays do not change state.)

The user application program can monitor the relay inhibiting status and act accordingly. Also, when the module's relays are inhibited, any mismatch between the relay position and the output logical state is ignored.

The Mixed I/O modules Analog-to-Digital conversion resolution is 16 Bit (including sign). Each input is fully isolated from the other inputs on the module and also optically isolated from the module internal circuits. The modules are fully calibrated. It is possible to test and re-calibrate the module in the field.

The measured values are digitally filtered to reduce the 50 or 60 Hz noise. The user can select the filtering frequency per module.

The measured values can be smoothed by digital filtering. Smoothing is accomplished by calculating the running average values of a defined number of converted analog values (samples). The user can select the level of smoothing per module. The higher the smoothing level chosen, the more stable is the smoothed analog value and the longer it takes until the smoothed analog signal is applied after a step response.

The user can select how the analog values are represented to the user application program, as unitless numeric values or as scaled values that represent certain Engineering Units (EGU).

Each AI module can include an optional plug-in floating 24V DC power supply to power external devices.

Each analog input has two Status LEDs:

- UF - indicates Underflow when lit
- OF - indicates Overflow when lit

The Mixed I/O modules support an optional 24V DC floating plug-in power supply (for contact “wetting” or other purposes).

For a description of I/O module construction, location, LEDs, TB holder, and other common I/O module features, see the I/O Modules chapter above. For details on Mixed I/O Module specific parameters and configuration, see the Mixed I/O Module Configuration section below.

Mixed I/O Module Configuration

For configuration of the DIs, refer to the DI Module chapter.

For configuration of the DOs, refer to the DO/DI FET Module or DO Relay Module chapter.

For configuration of the AIs, refer to the AI Module chapter.

Sleep Mode

Each Mixed I/O module can be switched by the user application program to Sleep Mode. In Sleep Mode, the module does not function and the power consumption is minimized. During Sleep mode the user application program will get the predefined values per each I/O.

Module Status and Diagnostics

In the event of Mixed I/O Module failure, the ERR LED will be lit. This event is registered by the CPU in the Error Logger. DI Module failure status is also visible to the user application program.

The Mixed I/O module can be diagnosed and monitored using the STS Hardware Test utility.

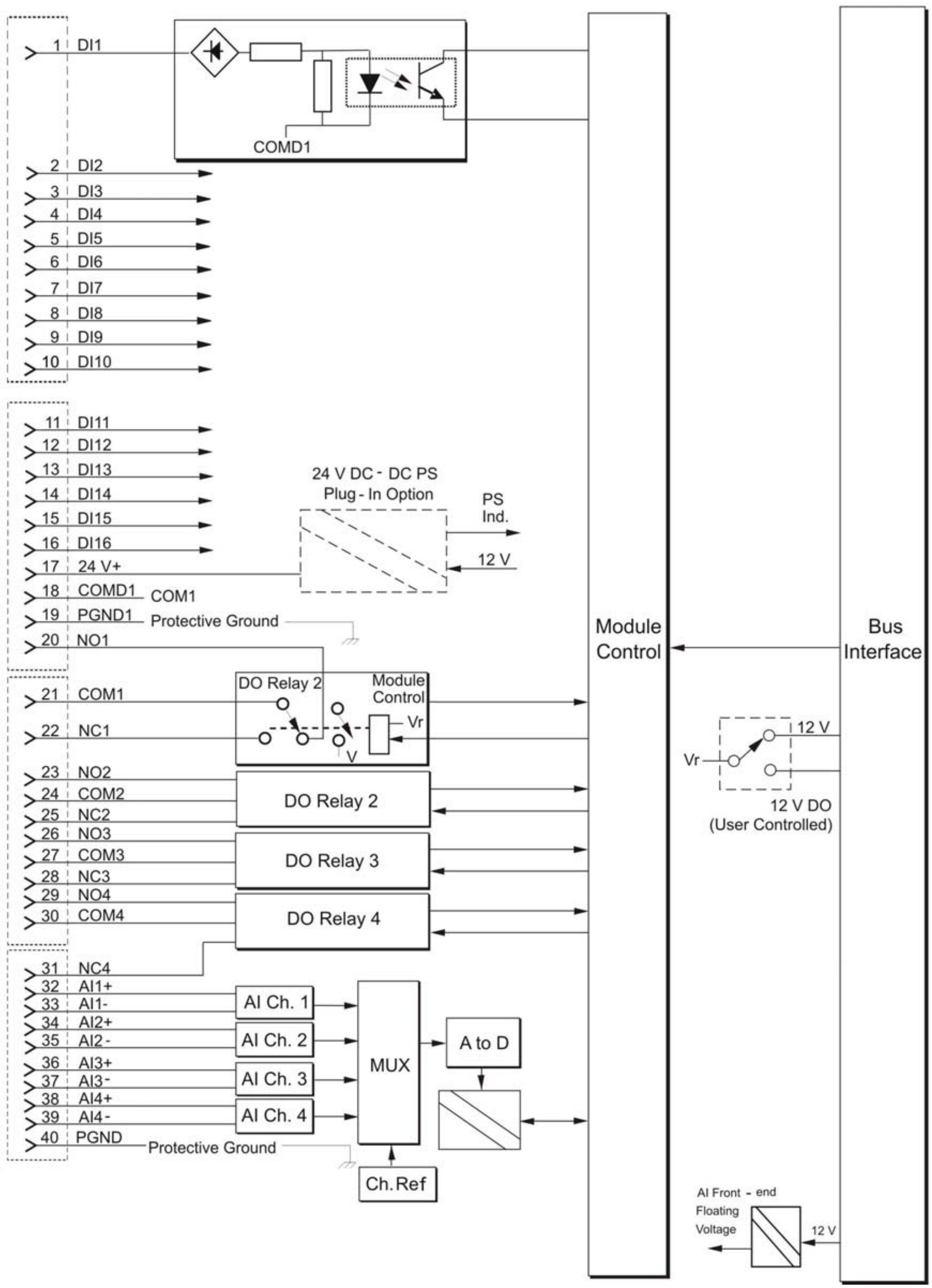
For Hardware Test of the DIs, refer to the DI Module chapter.

For Hardware Test of the DOs, refer to the DO/DI FET Module or DO Relay Module chapter.

For Hardware Test of the AIs, refer to the AI Module chapter.

Module Block Diagram

Mixed I/O



Connection Charts

Mixed I/O

Pin	Function	Pin	Function
1	DI1	21	COM1
2	DI2	22	NC1
3	DI3	23	NO2
4	DI4	24	COM2
5	DI5	25	NC2
6	DI6	26	NO3
7	DI7	27	COM3
8	DI8	28	NC3
9	DI9	29	NO4
10	DI10	30	COM4
11	DI11	31	NC4
12	DI12	32	AI1+
13	DI13	33	AI1-
14	DI14	34	AI2+
15	DI15	35	AI2-
16	DI16	36	AI3+
17	24V+	37	AI3-
18	COM1	38	AI4+
19	PGND1	39	AI4-
20	NO1	40	PGND

Mixed I/O Module Specifications

Total Number of Inputs / Outputs	16 Digital Inputs + 4 EE Relay Outputs + 4 Analog Inputs (±20 mA) 16 Digital Inputs + 4 ML Relay Outputs + 4 Analog Inputs (±20 mA)
I/O Arrangement	1 group of 16 DIs with shared common 4 relay outputs - Form C 4 isolated analog inputs
DI Counter Inputs	The first 12 inputs can be configured as fast counters.
DI Frequency	0 - 1 KHz
DI Fast Counter Frequency	0 - 5 KHz, minimum pulse width 100 µS
DI Max. DC Voltage	Max. 40 V DC
DI "ON" DC Voltage Range	+11 to +30 V DC, -30 to -11 V DC
DI "OFF" DC Voltage Range	-5 to +5 V DC
DI Current	6-10 mA
Fast Capture Resolution	1 mS (Interrupt upon change of state)
Event Time Tagging Resolution	1 mS (Interrupt upon change of state)
DI Filtering	0 to 50.8 mS (DC, programmable in 0.2 mSec steps)
DI Counter Filtering	0 to 12.75 mS (programmable in 0.05 mSec steps for inputs configured as high speed counters)
DO Contact Voltage Ratings	Max. 60 V DC or 30 V AC RMS (42.4 V peak).
DO Contact Power Ratings	2A @ 30 V DC, 0.6A @ 60V DC or 0.6A @ 30V AC (resistive load)
DO Relay Back Indication	Contact position - hardware back indication
DO Fail State	Configurable relay state on CPU fail: On, Off or 'last value'
AI Resolution	16 Bit (including sign)
AI Accuracy	±0.1% of full scale @ -40ºC to +70ºC
AI Sampling Time	10 mSec @ 50 Hz filtering 8.33 mSec @ 60 Hz filtering
AI Smoothing	Selectable input averaging: 1, 2, 4, 8, 16, 32, 64 or 128 samples (x10 mS)
AI max. Potential between AIs	75 V DC, 60 V AC (RMS)
AI Impedance	Rin < 250 Ω
AI Crosstalk Rejection	Better than 80 dB between any pair of inputs

AI Temperature Stability	25 PPM/ºC
AI Interference Suppression	Selectable 50 or 60 Hz filtering, common mode rejection > 100 dB, differential mode rejection > 50 dB
Diagnostic LEDs	Module error LED, Status LED per each DO and DI. Overflow and Underflow LED per each AI, 24V Plug-in status LED (AI) AI Overflow and Underflow levels can be configured to: Current inputs: ±20mA / 4-20 mA Voltage inputs: ±5 V / 0-5 V /1-5 V
24 V DC Output	Supports one isolated 24V A plug-in "wetting" power supply
User Connection	4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable and TB Holder	40 wire cable with Terminal Block Holder connector, 26 AWG
Module Replacement	Hot swap replacement– module extraction/insertion under voltage
Input / Output Isolation	DI: 2.5 kV RMS between input and module logic per IEC60255-5 DO: Between open contacts: 1kV, between output and module logic: 1.5 kV per IEC60255-5 AI: 1.5 kV between input and module logic per IEC60255-5
Input Insulation	Insulation resistance 100 MΩ @ 500 V DC per IEC60255-5
Operating Voltage	10.8-16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	Approx. 0.31 Kg (0.68 Lb)

Specifications subject to change without notice.

MIXED ANALOG MODULE

General Description

The ACE3600 Mixed Analog modules include a mixture of Analog Inputs and Analog Outputs on the same module.

The available Mixed Analog modules are:

- 4 Analog Outputs + 8 Analog Inputs (±20 mA) (supports 4-20 mA)
- 4 Analog Outputs + 8 Analog Inputs (±5V) (supports 0-5 V and 1-5V)

Figure 15-1 provides a general view of the ACE3600 Mixed Analog module.

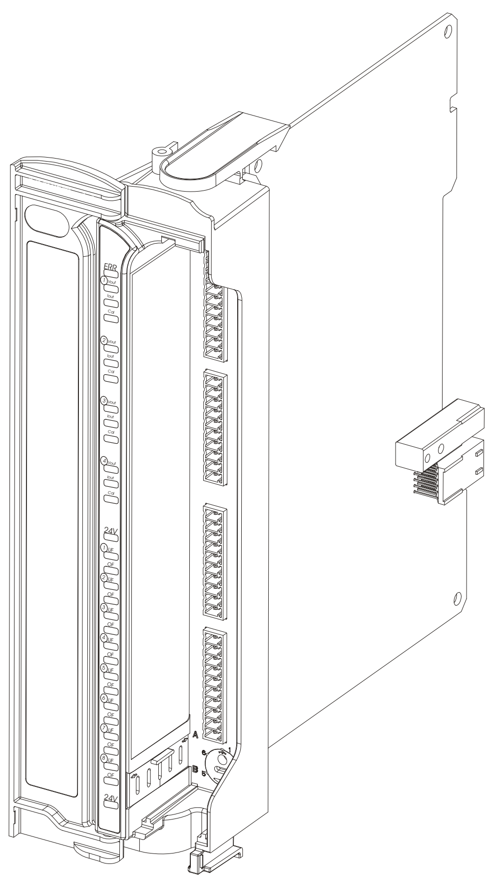


Figure 15-1 ACE3600 Mixed Analog Module – General View

Figure 15-2 provides a detailed view of the Mixed Analog module front panel.

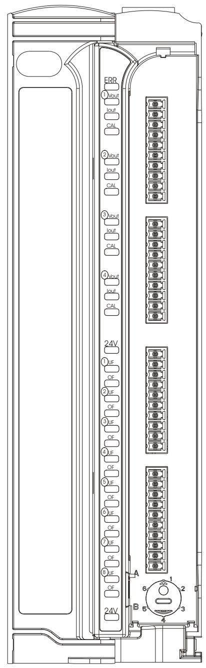


Figure 15-2 ACE3600 Mixed Analog Module – Front Panel

For a description of the AIs in the Mixed Analog modules, see the Analog Input Module chapter. For a description of the AOs in the Mixed Analog modules, see the Analog Output Module chapter.

The Mixed Analog modules support an optional 24V DC floating plug-in power supply to power external devices.

For a description of I/O module construction, location, LEDs, TB holder, and other common I/O module features, see the I/O Modules chapter above. For details on Mixed Analog Module specific parameters and configuration, see the Mixed Analog Module Configuration section below.

Mixed Analog Module Configuration

For configuration of the AIs, refer to the AI Module chapter.

For configuration of the AOs, refer to the AO Module chapter.

Sleep Mode

Each Mixed Analog module can be switched by the user application program to Sleep Mode. In Sleep Mode, the module does not function and the power consumption is minimized. During Sleep mode the user application program will get/set the predefined values per each I/O.

Module Status and Diagnostics

In the event of Mixed Analog Module failure, the ERR LED will be lit. This event is registered by the CPU in the Error Logger. AI Module failure status is also visible to the user application program.

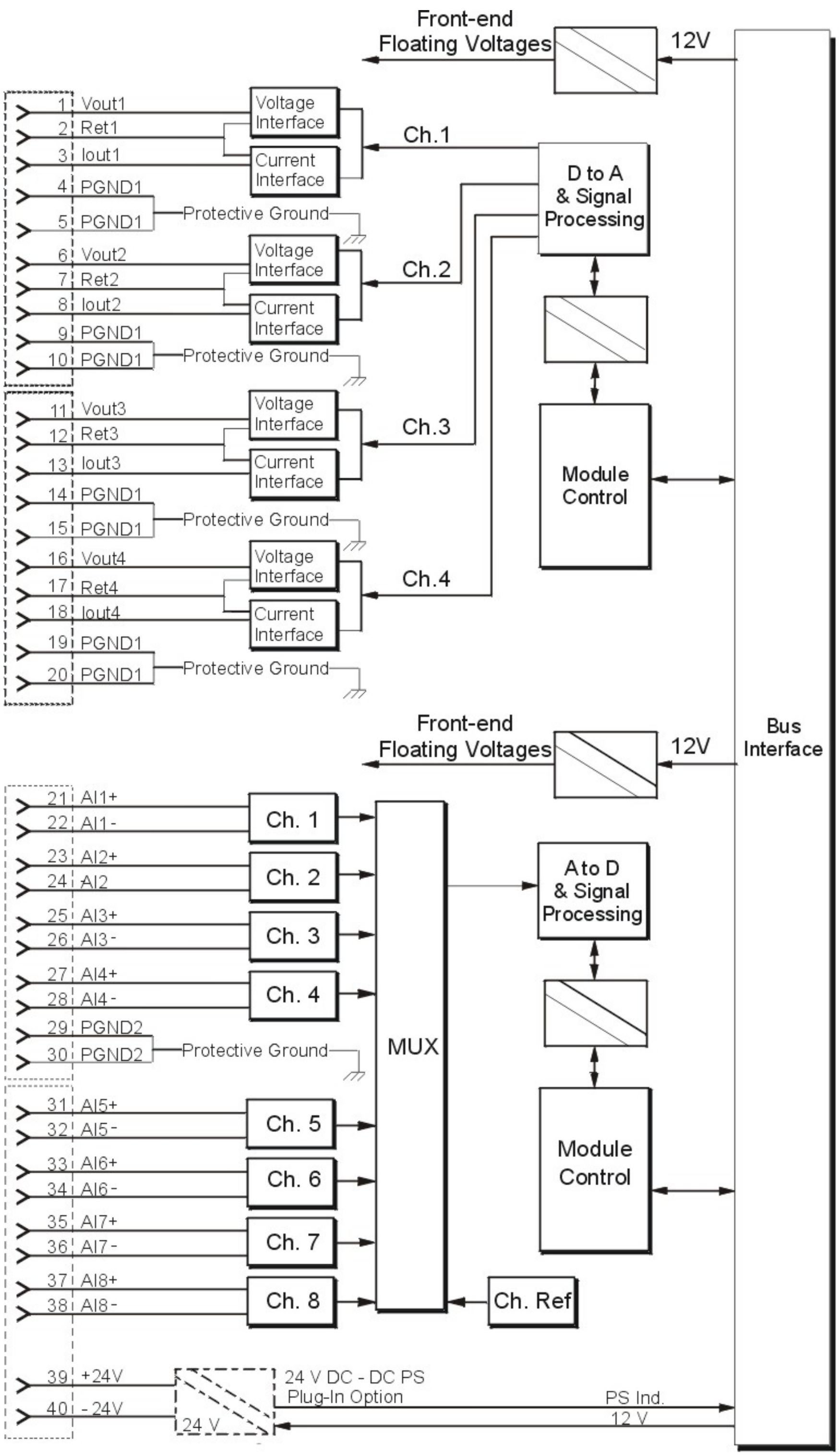
The Mixed Analog module can be diagnosed and monitored using the STS Hardware Test utility.

For Hardware Test of the AIs, refer to the AI Module chapter.

For Hardware Test of the AOs, refer to the AO Module chapter.

Module Block Diagram

Mixed Analog



Connection Charts

4AO/8AI

Pin	Function	Pin	Function
1	Vout1	21	AI1+
2	Ret1	22	AI1-
3	Iout1+	23	AI2+
4	PGND1	24	AI2-
5	PGND1	25	AI3+
6	Vout2	26	AI3-
7	Ret2	27	AI4+
8	Iout2	28	AI4-
9	PGND1	29	PGND2
10	PGND1	30	PGND2
11	Vout3	31	AI5+
12	Ret3	32	AI5-
13	Iout3	33	AI6+
14	PGND1	34	AI6-
15	PGND1	35	AI7+
16	Vout4	36	AI7-
17	Ret4	37	AI8+
18	Iout4	38	AI8-
19	PGND1	39	+24V
20	PGND1	40	-24V

Mixed Analog Module Specifications

Total Number of I/Os	4 Analog Outputs + 8 Analog Inputs (±20 mA) or 4 Analog Outputs + 8 Analog Inputs (±5V DC)
I/O Arrangement	AO - each channel can be connected as 0-20 mA or 0-10 V, AI - Isolated (floating) analog inputs
AO D to A Resolution	14 bit
AO Accuracy	±0.1% full scale @ 25ºC
AO Temperature Stability	25 PPM/ºC
AO Internal Settling Time	Max. 1.0 msec
AO Load	Voltage: > 1.0 kΩ, < 1.0 µf Current: < 750 Ω (with internal power supply)
AO Crosstalk Rejection	Better than 50 dB between any pair of outputs
AO Interference Suppression	Common mode rejection > 60 dB
AO Voltage Output Protection	Short circuit protection, max. 30 mA (all other operating channels remain fully functional)
AO Current Output No-load Voltage	Max. 22.0 V DC
AO Isolation	1.5 kV between output and module logic
AO Insulation	Insulation resistance 100 MΩ @ 500 V DC per IEC60255-5
AI A to D Resolution	16 Bit (including sign)
AI Accuracy	±0.1% full scale
AI Sampling Time	10 mSec @ 50 Hz filtering 8.33 mSec @ 60 Hz filtering
AI Smoothing	Selectable input averaging: 1, 2, 4, 8, 16, 32, 64 or 128 samples (x10 mS)
Permitted. Potential between Inputs	75 V DC, 60 V AC (RMS)
AI Input Impedance	±20 mA input: Rin < 250 Ω ±5 V input: Rin > 1 MΩ
AI Crosstalk Rejection	Better than 80 dB between any pair of inputs
AI Temperature Stability	25 PPM/ºC
AI Interference Suppression	Selectable 50 or 60 Hz filtering, common mode rejection > 100 dB, differential mode rejection > 50 dB
24 V DC Output	Supports one isolated 24V Plug-in "wetting" power supply

Diagnostic LEDs	AO - Voltage mode LED, Current mode LED, Calibration LED per channel AI - Overflow and Underflow LED per each input, 24V Plug-in status LED The module Overflow and Underflow levels can be configured to: Current inputs: ±20mA / 4-20 mA Voltage inputs: ±5 V / 0-5 V /1-5 V General - Module error LED
AI Input Isolation	1.5 kV between input and module logic
AI Input Insulation	Insulation resistance 100 MΩ @ 500 V DC per IEC60255-5
User Connection	4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable and TB Holder	40 wire cable with Terminal Block Holder connector, 26 AWG
Module Replacement	Hot swap replacement– module extraction/insertion under voltage
Operating Voltage	10.8-16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	Approx. 0.34 Kg (0.75 Lb)

Specifications subject to change without notice.

I/O EXPANSION

General Description

The ACE3600 RTU includes the option of expanding the number of I/O modules controlled by a single CPU module on the main frame. The I/O expansion frames can be co-located with RTU on the main frame (installed in the same 19” rack or cabinet) or distributed in the same site (up to 50 meters from the main frame.)

I/O expansion is based on a 100 Base-T full duplex Ethernet connection between the CPU module and the expansion modules. This type of connection enables the user program application to control and monitor the I/O modules on the expansion frames transparently in the same way it controls and monitors the I/O modules on the main frame.

The user can diagnose all the modules on the expansion frames using the STS via the CPU on the main frame. The STS can also be connected locally through the expansion module’s STS1 RS232 port.

I/O expansion is based on three modules:

- Expansion LAN Switch: This module is part of the expansion frame. It is installed in the main frame in an I/O module slot. Up to seven expansion frames can be connected through a single expansion LAN switch. (For one expansion frame, the switch is not required.) Eight to thirteen expansion frames can be connected using a combination of two expansion LAN switches. For information, see the Expansion LAN Switch chapter below.

- Expansion Power Supply: This module is installed in the I/O expansion frame. It extends power (and 12V DO control) from the power supply on the RTU’s main frame to the I/O expansion frame, or from one I/O expansion frame to another. For more information, see the Expansion Power Supply Module chapter below. This module can be replaced by another ACE3600 power supply option per power requirements or when the expansion frame is not co-located with the main frame. For a list of power supply options, see the Power Supply Module and Backup Battery chapter above.

- Expansion Module: This module is part of the expansion frame. It is installed in the I/O expansion frame next to the power supply. It is connected via LAN to the RTU’s main frame, either to the CPU module or to the expansion LAN switch, depending on the configuration. For more information, see the Expansion Module Chapter below.

Note: Only a dedicated LAN should be used by the main CPU and expansion modules to communicate with each other. Connecting other elements to the LAN may disrupt system operation.

Note: The main CPU must include an Eth1 Ethernet port. Therefore, only the CPU 3640 can be used for I/O expansion.

Figure 16-1 provides a general view of an ACE3600 CPU with a single I/O expansion frame. The expansion module on the I/O expansion frame is connected using a crossed LAN cable to the CPU 3640 on the main frame (Port Eth1.) The expansion power supply on the I/O expansion frame is attached via DC cable to the power supply on the main frame. Accessories such as a mobile radio, battery, and plastic accessory box are attached to a separate optional 19" chassis.

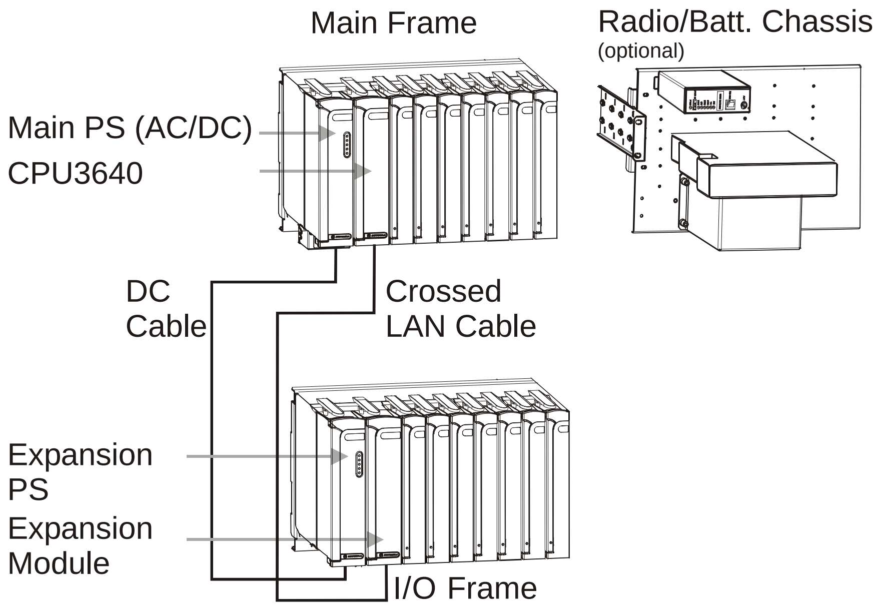


Figure 16-1 ACE3600 I/O Expansion – Single Frame Example

Figure 16-2 provides a general view of an ACE3600 CPU with multiple I/O expansion frames (two to seven.) The CPU on the main frame (Port Eth1) is connected using a LAN cable to the LAN switch on the main frame (Port Eth1-M). The expansion modules on each of the seven I/O expansion frames are connected using a LAN cable to the expansion LAN switch (Eth2-Eth8) on the main frame. The expansion power supply on the first I/O expansion frame is attached via DC cable to the power supply on the main frame. The power supplies on the other I/O expansion frames are each attached via DC cable to the power supply on the previous I/O expansion frame, in a daisy-chain manner. Accessories such as a mobile radio, battery, and accessory box are attached to a separate 19" chassis.

Note that the number of chained frames is limited by the total power and voltage drop.

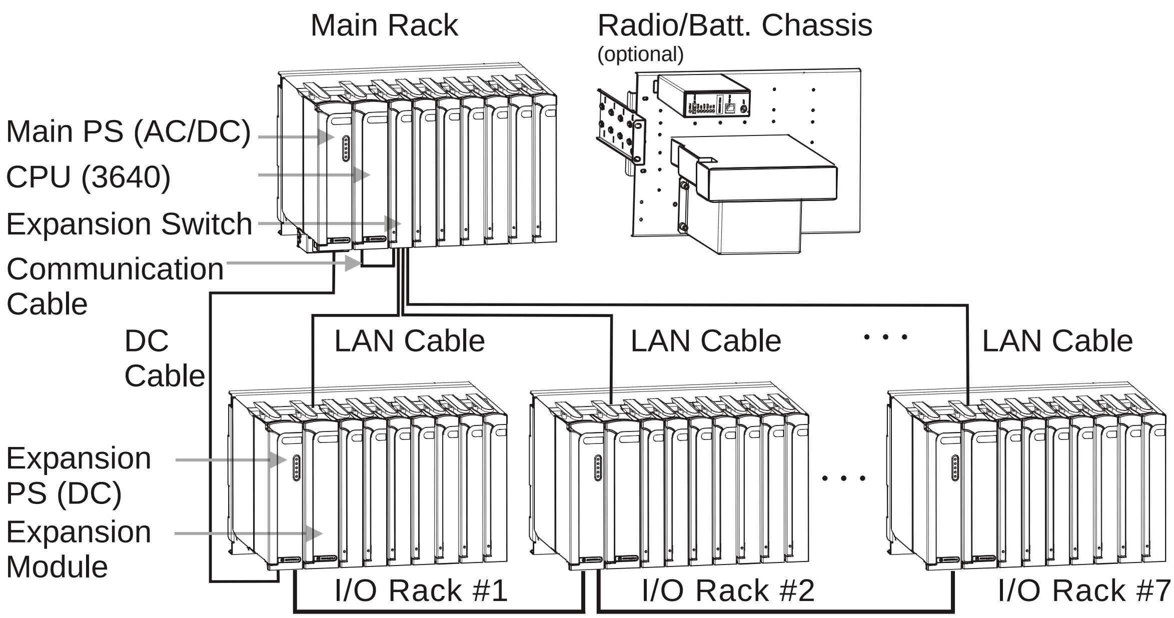


Figure 16-2 ACE3600 I/O Expansion – Multi-Frame Example

Note: The number of expansion power supplies that can be cascaded to the power supply on the main frame is limited. When required, DC or AC power supplies should be installed on the expansion frames to meet the accumulated power consumption requirements.

In the maximal configuration, up to 110 I/Os can be connected to the ACE3600, by using two expansion LAN switches on the main frame and thirteen I/O expansion frames. See Figure 16-3.

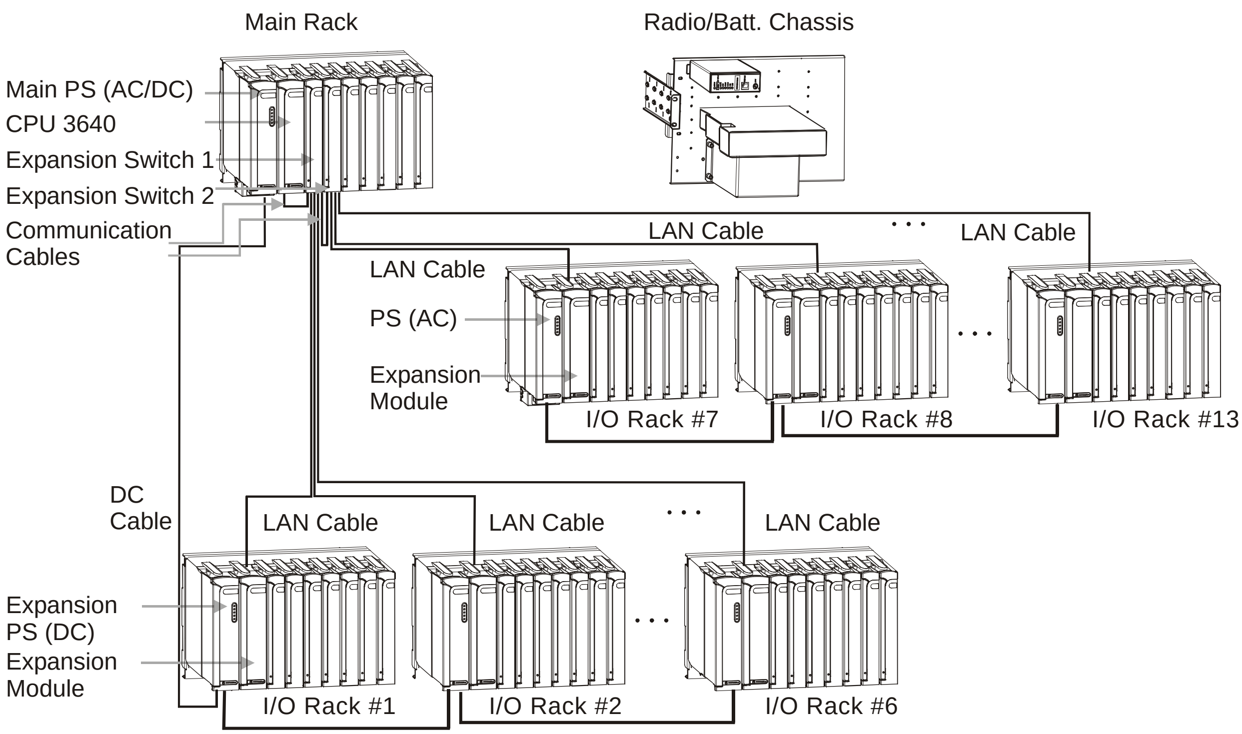


Figure 16-3 ACE3600 I/O Expansion – Maximal I/O Configuration

I/O Expansion Frame

An I/O expansion frame must always include an expansion module to enable the CPU in the main frame to communicate with and control the expansion frame and its I/O modules. The expansion module is provided with each expansion frame model.

Like the ACE3600 main frame, the I/O expansion frame can contain 3, 5, 7 or 8 I/O slots. The expansion frame is compatible with the existing chassis and housing options.

I/O Expansion Power

The choice of power supplies for a system with I/O expansion is determined by the specific configuration and the power requirements of the system.

In a co-located system where the power supply on the main frame feeds the I/O expansion frame, a low-tier power supply cannot serve as the main power supply.

In a distributed system where the power supply on the I/O expansion frame is not connected to the main frame, any power supply modules can be used which suit the power requirements of the system. When applicable, it is recommended to have an external single power on/off switch to control all power supplies simultaneously. Similarly, it is recommended to have a single on/off for all 12V DO controls. If a DC power supply low tier is used on the expansion frame, it does not include the 12V DO control, and it cannot provide power (in a daisy-chain manner) to other expansion power supplies.

For guidelines on selecting the power supplies for a particular ACE3600 RTU with I/O expansion, see the ACE3600 System Planner.

Power-up/Restart/Power-down

In a system where the power supply on the main frame feeds the I/O expansion frame, powering up/restarting the main power supply will power-up/restart the expansion frames as well. Powering down the main power supply will power-down the expansion I/Os as well.

In a system where the power supply on the I/O expansion frame is not connected to the main frame, powering down or restarting the main power supply will not power-down the I/Os on the expansion frame. However, these expansion I/Os may be reset after a period of time as a result of this action. If the expansion frame loses communication with the main frame for more than a certain number of seconds (configurable), it will restart. For more information, see the Expansion Module chapter below. For information on configurable timeouts which may cause the expansion module to restart, see the ACE3600 STS User Guide - Appendix A: Site Configuration Parameters.

Status and Diagnostics

Status and diagnostics information can be retrieved from the expansion module, LAN switch, and power supply using the STS Hardware Test utility and SW Diagnostics and Loggers, via the CPU on the main frame. In a system where the expansion is not co-located with the main frame, status and diagnostics information on the expansion components can be retrieved by connecting directly to the expansion module. For more details, see the relevant chapter in this manual and the Hardware Test section of the ACE3600 STS User Guide.

EXPANSION MODULE

General Description

The expansion module provides an interface from the CPU module (either directly or via the expansion LAN switch) on the ACE3600 main frame to the I/O modules on the expansion frame. This enables the CPU on the main frame to control the I/O modules on the expansion frame and process the gathered data.

This module is installed in the I/O expansion frame in the second slot from the left and is connected via dedicated LAN to the RTU's main frame.

Figure 17-1 provides a general view of the ACE3600 expansion module.

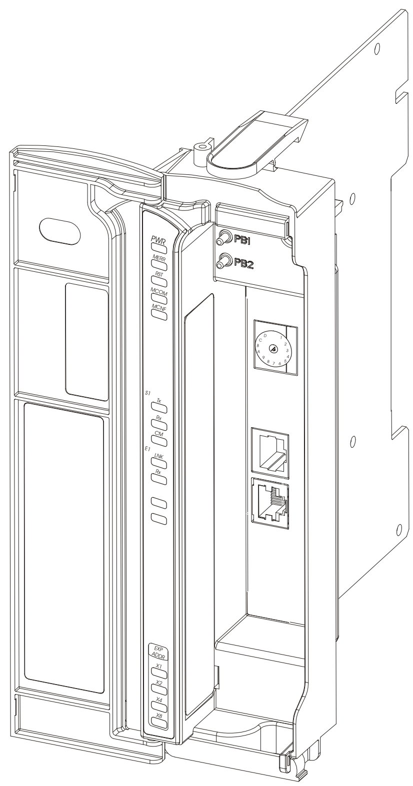


Figure 17-1 ACE3600 Expansion Module – General View

The front panel includes status LEDs, expansion address LEDs, communication port LEDs, two pushbuttons, communication ports and rotary switch. The panel is covered by the module door.

Figure 17-2 provides a detailed view of the expansion module front panel.

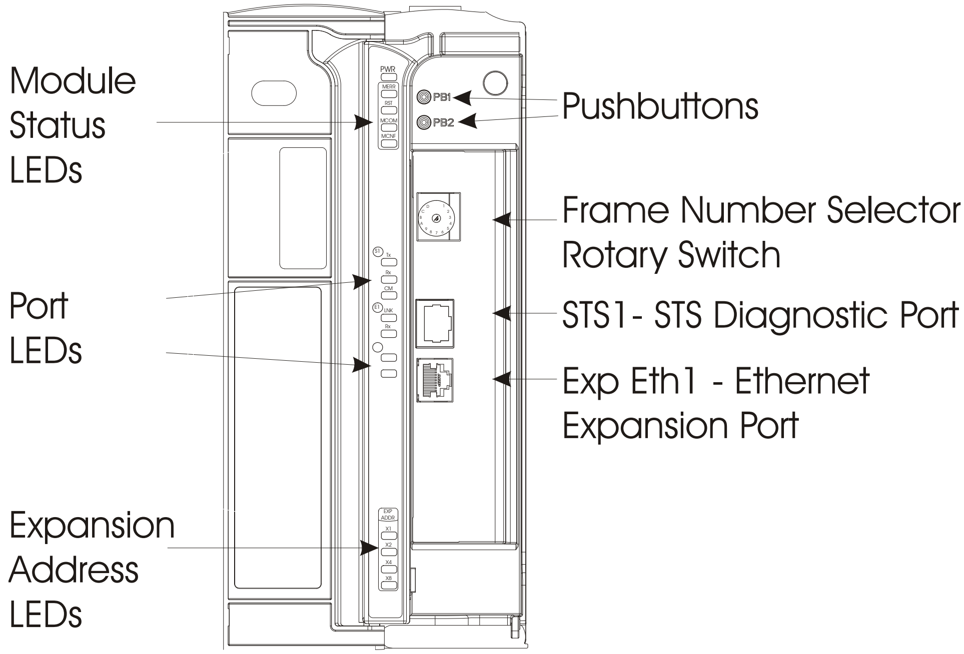


Figure 17-2 ACE3600 Expansion Module – Front Panel

Front Panel

Pushbuttons

The expansion module includes two pushbuttons on the front panel, PB1 and PB2.

These pushbuttons are used for activating and testing the modules LED, restarting the unit, and activating memory test. See the Pushbutton Functionality section below for information on pushbutton functionality.

Note: The pushbuttons cannot be monitored by the user application program (when it is running) for the application purposes. The pushbutton status can be checked using the Hardware Test utility.

Frame Number Selector Switch

The expansion module includes a (rotary) selector switch which enables the user to determine the frame number in the expanded RTU. The frame number is used during communication with the main CPU, with the STS, etc. For instructions on setting the frame number, see Setting the Frame Number below.

Communication Ports

The expansion module includes two on board communication ports:

- Exp Eth1 (E1) - 10/100BaseT Ethernet port, used to connect to the expansion LAN switch or to the main CPU
- STS 1 (STS1) – RS232 port 115200 bps, used to connect a PC running the ACE3600 STS to perform diagnostics and other STS operations (for distributed I/O), as if it is connected directly to the main CPU (i.e. it provides access to the whole system.)

For the detailed specifications of each port, see the Expansion Module Specifications below. For information on the cables and connectors, see Connecting the Expansion Module below and Appendix C.

Note: When connecting an Ethernet cable to the main CPU, add one Fair-Rite ferrite core (#7683477X01 from the supplied ferrite kit FHN7007A) on each end of the cable, near the connectors. Each core has two turns. When connecting an Ethernet cable to the expansion module, add one Fair-Rite ferrite core (#7683477X01 from the supplied ferrite kit FHN7007A) on each end of the cable, near the connectors. Each core has two turns. (The number of turns when using ferrite cores is determined by the times the cable/wire crosses the internal aperture of the core.)

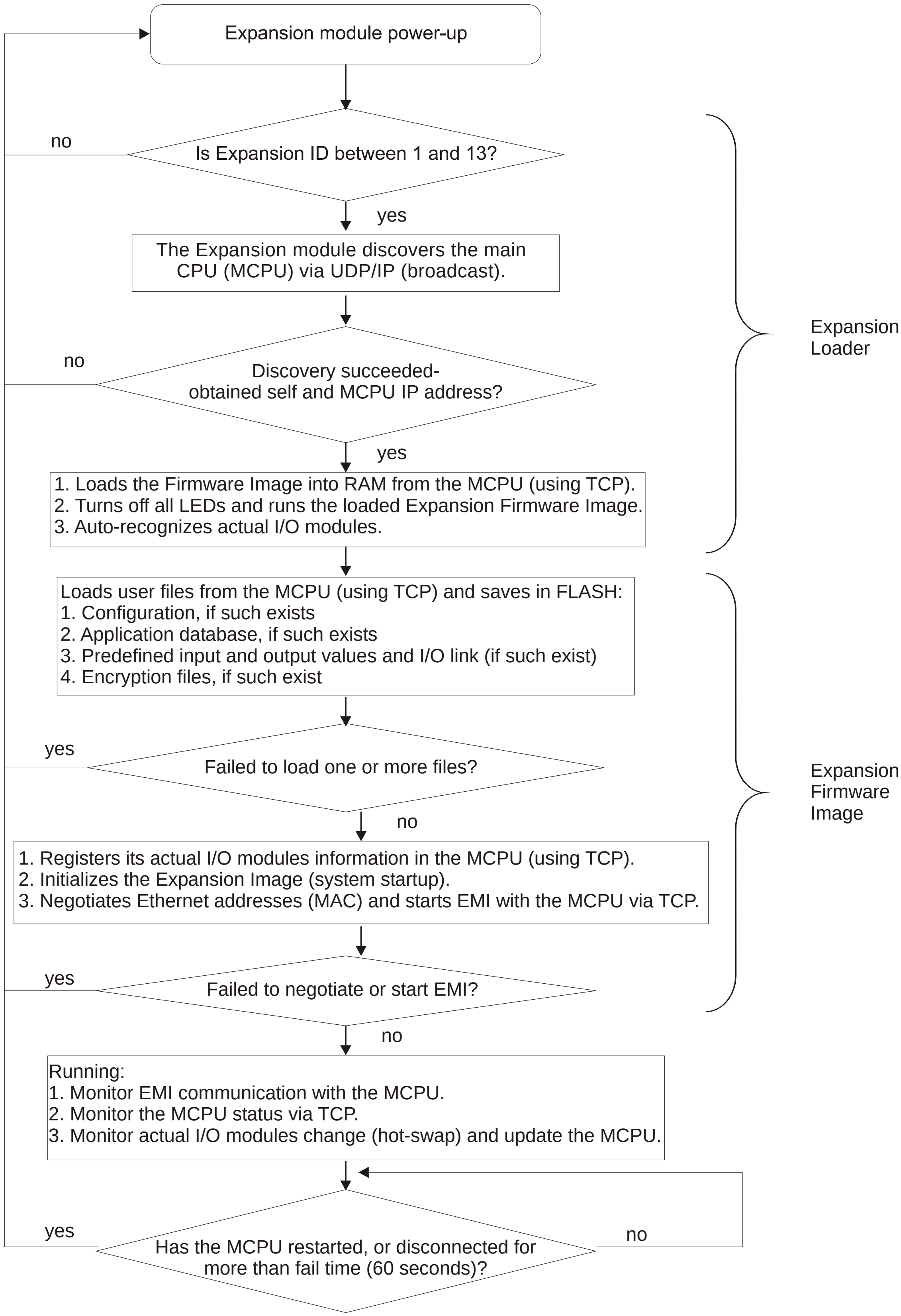
LEDs

The expansion modules include module status LEDs, port status LEDs, and expansion address LEDs. Some of the LEDs are single color (green) and some are bicolor LEDs (red, green or orange).

Status LEDS indicate the expansion module status in startup (boot), run-time or when there is a failure. The communication LEDs are used to indicate the communication port status. The expansion address LEDs indicate the address selected with the rotary frame number selector switch, as detected during startup. Note that during startup or failure, the communication and expansion address (EXP ADDR) LEDs are used to indicate various situations. Table 17-1 details the LEDs functionality.

Module Firmware and Operation Modes

The expansion module firmware extends the main CPU control to the I/O modules located in the expansion frame. The expansion module (expansion CPU) is shipped from the factory with dedicated firmware called Expansion Loader. After connecting to the main CPU (MCPU), the expansion module loads the Expansion Firmware Image from the main CPU to ensure that all modules use the same firmware version. The diagram below depicts the initiation process of an expansion module after power-up/restart and during run-time:


Expansion module power-up
Is Expansion ID between 1 and 13?
no
yes
The Expansion module discovers the main CPU (MCPU) via UDP/IP (broadcast).
Discovery succeeded- obtained self and MCPU IP address?
no
yes
1. Loads the Firmware Image into RAM from the MCPU (using TCP).
2. Turns off all LEDs and runs the loaded Expansion Firmware Image.
3. Auto-recognizes actual I/O modules.
Expansion Loader
Loads user files from the MCPU (using TCP) and saves in FLASH:
1. Configuration, if such exists
2. Application database, if such exists
3. Predefined input and output values and I/O link (if such exist)
4. Encryption files, if such exist
Failed to load one or more files?
yes
no
1. Registers its actual I/O modules information in the MCPU (using TCP).
2. Initializes the Expansion Image (system startup).
3. Negotiates Ethernet addresses (MAC) and starts EMI with the MCPU via TCP.
Failed to negotiate or start EMI?
yes
no
Expansion Firmware Image
Running:
1. Monitor EMI communication with the MCPU.
2. Monitor the MCPU status via TCP.
3. Monitor actual I/O modules change (hot-swap) and update the MCPU.
Has the MCPU restarted, or disconnected for more than fail time (60 seconds)?
yes
no

Power-up and Restart

The MCOM LED (see LED description in Table 17-1) on the expansion module indicates the connection status between the expansion module and the main CPU and expansion frame initialization progress.

The main CPU expects the expansion frames to complete the initialization within a configurable period of time (60 seconds default). After this period of time elapses, the main CPU will operate normally with the connected frames and their I/O modules. Any expansion frame that has not completed initialization within that time (e.g. because it was connected later to the RTU) will be ignored until the next main CPU restart.

Note that after the main CPU starts up, it waits for the expansion modules to complete the initialization process. The wait time is derived from the number of expansion frames configured in the RTU. After all the expansion frames have completed the initialization, the main CPU will continue its system startup. The main CPU will wait 60 seconds (default) for all expansion frames to connect.

Restart after Firmware Download

After a new version of the firmware is downloaded to the main CPU, the CPU and all expansion modules will restart (as with configuration download or main CPU power reset.) Note that the restart includes the time to identify all expansion frames, as described above. After a new version of the Expansion Loader firmware is downloaded to the expansion module (using the STS Hardware Test feature), the expansion module will restart itself. For information on upgrading the Expansion Loader firmware, see the ACE3600 STS User Guide.

Restart after Configuration Download

After a site configuration is downloaded to the main CPU, the CPU will restart and will instruct the expansion modules to restart as well. Note that the restart includes the time to identify all expansion frames, as described above. For information on downloading to the RTU, see the Operation chapter of the ACE3600 STS User Guide.

If the RTU fails to restart after the user-defined site configuration was downloaded, a unique LED display (in the range of the PI1-TX and SI2-RX LEDs) will follow. The RST LED will turn RED and the RTU will restart itself with the previous “good” configuration. The expansion module will be restarted. The following message will appear in the RTU Error Logger “Configuration file was deleted due to failure in startup. Rolling back to the last configuration file.” Errors can be retrieved from the RTU using the ACE3600 STS Error Logger utility.

If the newly-downloaded configuration has a problem which prevents the expansion module from connecting to the main CPU, the expansion module is restarted, and will operate in Expansion Loader mode. It will restart every two minutes, and be unable to perform discovery/load image from main CPU. If the site’s I/O configuration includes one or more frames, a warning is displayed in the main CPU. If no frames were configured for the site, the main CPU will ignore all Expansion Loader discovery requests.

If the startup succeeds after configuration download but has errors, these errors are reported in the RTU Error Logger. It is, therefore, recommended to check for errors after downloading a configuration file to the RTU. Errors can be retrieved from the RTU using the ACE3600 STS Error Logger utility.

For information on retrieving errors from the RTU Error Logger, see the Operation chapter of the ACE3600 STS User Guide.

Restart after Erase Flash

After the User Flash is erased in the main CPU, the RTU will restart with the default site configuration and all expansion modules will restart. Note that the restart includes the time to identify all expansion frames, as described above.

Expansion Module during Run-Time

The expansion module constantly exchanges I/O data and status data with the main CPU, using the Ethernet Microcode Interface (EMI). The EMI enables the main CPU to be updated by all the expansion modules at very short intervals via the expansion Ethernet LAN. The main CPU constantly synchronizes the expansion module date and time, and periodically polls the errors, pushbuttons and time tagged data from all the connected expansion modules.

If the connection between the expansion module and the main CPU is lost (e.g. due to main CPU restart, cable disconnection, etc.) for a configurable period of time (1 minute default), the expansion module will restart and the initialization process will begin again.

After the expansion frames have initialized, it is possible to download to the RTU a user program or other user defined files. After successful download, the main CPU automatically updates each expansion module. Note that if the main CPU tries to download a user program or other files to an expansion module during initialization, the expansion module is restarted.

Power-down

When the voltage provided to the expansion module (from the power supply on the expansion frame) drops below the minimum level, the module will shut down in an orderly fashion. When the expansion frame is powered using an expansion power supply (or 12V low-tier power supply), it may shut down when the voltage drops below 10.8 V. When the expansion frame is powered using other types of ACE3600 power supplies, this level is configurable. See the ‘Minimum DC operation voltage’ parameter in Appendix A: Site Configuration Parameters of the ACE3600 STS User Guide.

File Download without Restart

When certain files (e.g. I/O FPGA, encryption keys, compiled ladder) are downloaded from the STS to the main CPU, the main CPU will “forward” the files to the expansion modules, without forcing a restart. The main CPU will restart the expansion modules if the “forward” operation fails for some reason (e.g. temporary loss of communication.)

Module Status and Diagnostics

The module status is indicated on the front panel LED. Detailed module status and diagnostics information can be retrieved via the main CPU using the STS Hardware Test utility. For more details, see the Hardware Test section of the ACE3600 STS User Guide.

Module Warnings and Errors

Expansion module warnings and errors are logged in the main frame CPU memory to indicate issues or errors during power-up, restart, run-time, and other modes of CPU operation. If a warning or error occurs in any one of the RTU frames, the ERR LED will light up on the front panel of the main CPU and the MERR LEDs will light up on the front panel of all expansion modules. Green indicates a message, orange indicates a warning, and red indicates an error.

The RTU error logger information can be retrieved using the STS Error Logger utility. For more details, see the Error Logger section of the ACE3600 STS User Guide.

Connecting the Expansion Module

Install the expansion module in the second slot from the left in the expansion frame.

Direct connection: In a system with a single expansion frame, connect the Exp. Eth1 port on the expansion module directly to the Eth1 port on the main CPU, using the crossed Ethernet cable described below.

Switch connection:

- In an RTU with more than one expansion frame (and up to seven), connect the Exp. Eth1 port on the expansion module to one of the Ethernet ports Eth2-Eth8 on the expansion LAN switch (situated on the main frame). Note: The Eth.1 (M) port on the expansion LAN switch is reserved for connection to the main CPU.
- If two switches are used (more than seven expansion frames), connect the Exp. Eth1 port on the expansion module to one of the Ethernet ports (Eth3-Eth8) on the first expansion LAN switch or to one of the Ethernet ports (Eth2-Eth8) on the second switch. (Connect the Eth2 port on the first switch to the Eth1 (M) port on the second switch Ethernet LAN, as described in the Expansion LAN Switch chapter below.)

Expansion frames are provided without cables. For connection, use one of the cables listed below or use any other standard Category 5E shielded (FTP) LAN cable (up to 50m, per cable length limit.)

Four different Ethernet cables are available for this purpose. Choose the cable length based on the distance from the main frame to the expansion frame.

- 0.6 meter (Motorola p/n FKN8561A) - This cable is for local connection of the main CPU to the expansion switch.
- 2 meter (Motorola p/n FKN8562A)
- 3 meter (Motorola p/n FKN8563A)
- 3 meter (Motorola p/n FKN8525A) crossed cable - This cable is for direct connection of the expansion module to the main CPU.

For more on switch connection, see the Expansion LAN Switch chapter below.

Setting the Frame Number

The expansion module shipped from the factory is set by default to 1. If more than one I/O expansion frame is added, this frame number (also known as frame ID) must be changed. Procedure 17-1 describes how to set the expansion frame number using the rotary selector switch on the front panel of the expansion module. The frame number should be changed before powering up the module.

Procedure 17-1 How to Set the I/O Expansion Frame Number

1) Make sure that the expansion module is not connected to a power source.

2) Insert a small flat screwdriver into the groove on the rotary frame number selector. See Figure 17-3.

3) Using the screwdriver, turn the dial until the arrow points to the desired frame number. Note: The selected frame number must not already be assigned to another expansion module and must be in the range of 1-13 (1-9, A, B, C, D hexadecimal.)

4) Connect the expansion module to a power source.

5) When the expansion module is powered up, verify the selected frame number via the four binary Expansion Address (EXP ADDR) LEDs on the front panel. This is the frame number that will be used when communicating with the main CPU.

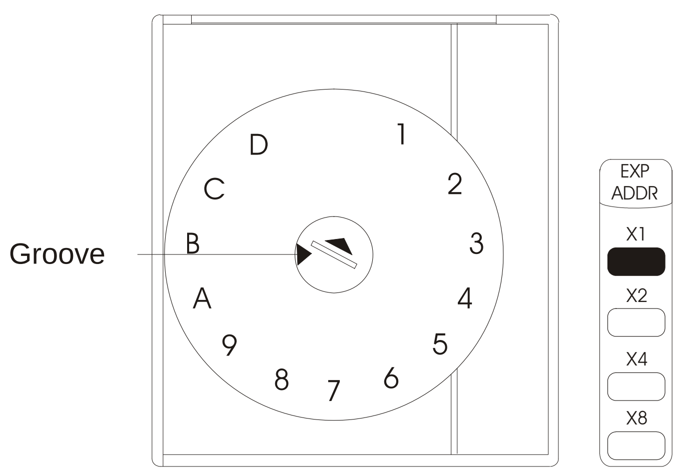


Figure 17-3 Expansion Module Rotary Frame Number Selector Switch and Expansion Address LEDs

NOTE

The rotary frame number selector switch should not be changed while the expansion module is running. If the switch is changed while the expansion module is running, the frame number will not be changed. A message will be logged in the Error Logger notifying the user of the switch change (specifying the actual frame number.)

If the frame number was set to a number other than 1-9/A-D before power-up, the expansion module will restart itself continually until the frame number is changed. The MERR LED will be red, but no error is logged. The invalid number (1-15) will be reflected in the Expansion Address LEDs.

If the frame number is changed after the Expansion Loader has begun discovery, but before the Expansion Image is started, the expansion module will restart itself and use the new frame number (assuming it is 1-9/A-D.)

It is recommended to set the frame numbers in sequential order (i.e. frame number 1 connected to the expansion LAN switch port Eth2, frame number 2 connected to expansion LAN switch port Eth3, etc.)

0 is an illegal frame number and is not represented by the EXP ADDR LEDs.

Pushbutton Functionality

In general, the two pushbuttons on the front panel of the expansion module behave like the pushbuttons on the front panel of the CPU module, with the exception of the Erase User Flash functionality and user application access which are not available.

Note: PB2 is not relevant during run time in the expansion module.

Scenario	Trigger	Action
LEDs Test	During run-time, press PB1 for five or more consecutive seconds (but less than 30).	All the LEDS on the expansion module and I/O modules on that expansion frame will be lit until let go of PB1 and then returned to their previous states.
Turn LEDs ON	During run-time, press PB1 for one second.	Those LEDs which are currently active will be turned on for a period of time (configured in the RTU configuration using the STS.)
Bootstrap	During startup, press PB2 continuously for five seconds. Note: Before initiating bootstrap, the expansion module must be connected directly to the STS PC in standalone mode. No other components can be on the network which might create a conflict with the default IP address.	The expansion will start up in diagnostic mode. Communication with the RTU is for diagnostic purposes only (Error Logger/ SW Diagnostics) or for downloading new primary image firmware to the module. (See Module Firmware and Operation Modes below.) If the bootstrap fails, the four indicator LEDs (see LEDs Location in Table 17-2) will display the failure error in binary code.

Scenario	Trigger	Action
RAM Test	During startup, press PB1.	A detailed memory test of SDRAM and SRAM plug-in is performed. - At the beginning of the RAM test, the four indicator LEDs (see LEDs Location in Table 17-2) will blink three times. During the RAM test, the LEDs may blink or be lit. If the RAM test succeeds, the four LEDs will blink three times and turn off and the restart sequence will continue. If the RAM test fails, the RTU will freeze (restart sequence stops), the PWR LED will blink and the four LEDs will blink seven times. The failure error code will then be displayed on the LEDs, in binary code, as described in Table 17-3. - To exit/abort the RAM test in the middle, restart the RTU using the On/Off switch on the front panel.

LEDs Behavior

The table below describes the behavior of the LEDs on the expansion module.

Table 17-1 Expansion Module LEDs Behavior

LED Name	Description	Status
PWR	Power LED Bicolor LED (Red, Green)	Flashing Red – Power exists; Module FPGA not loaded. Green – Power exists; Module is running from a recognized power supply. Red – Failure on power-up. Module is running from an unrecognized power supply.

LED Name	Description	Status
MERR	Main CPU Error Logger Status LED Bicolor LED (Red, Green)	OFF – No new errors or warnings logged in main CPU. Green – New message logged. Orange – New warning logged. Red – New error logged. Note: In systems with I/O expansion, all error messages from I/O expansion frames are periodically collected by the main CPU and saved with the main frame error messages. When an error message is logged in either the main frame or I/O expansion frames, the ERR LED is lit on the main CPU front panel and the MERR LEDs are lit on all expansion modules. When the messages are cleared, the ERR/MERR LED(s) are turned off.
RST	Reset LED Bicolor LED (Red, Green)	Green – On startup OFF – Successful power-up or restart. Red – Power-up or restart failed.
MCOM	Main CPU Communication LED Bicolor LED (Red, Green)	Red – Slow blink – Expansion Loader looking for main CPU (discovery). Red – Fast blink – Expansion Loader loading image. Red – Expansion module firmware initializing image. Green – Slow blink - Expansion module registered with main CPU. Green – Fast blink – Expansion module ready. (If this occurs after connection was established – solid green, it is a sign that the Expansion module is disconnected from the main CPU.) Green – Solid – Expansion module connected.

LED Name	Description	Status
MCNF	Main CPU Configuration LED Bicolor LED (Red, Green)	This LED reflects the state of the CONF LED in the main CPU: OFF – Configuration was not loaded in the main CPU. Green - Configuration was loaded in the main CPU. Red - Configuration error in the main CPU. This LED is only relevant after the main CPU has completed its startup.
SI1 TX	STS Port 1 – TX (transmit) Green LED	ON – Transmitting Data
SI1 RX	STS Port 1 – RX (receive) Green LED	ON – Receiving Data
SI1 CM	STS Port 1 – CM (channel monitor) Green LED	ON – Channel Monitor is ON.
E1 LNK	Ethernet Port 1 (link) Green LED	ON – Network Connected In case of RAM test, see Table 17-3.
E1 RX	Ethernet Port 1 (receive) Green LED	ON – Receiving Data In case of RAM test, see Table 17-3.
EXP ADDR x1, x2, x4, x8	Expansion address LEDs Green LED	Reflects the expansion address set in the rotary frame number selector switch. The four LEDs together form the binary representation of the addresses 1-D. See Figure 17-3. During module startup, the LEDs reflect communication errors. See Table 17-2.

Table 17-2 Expansion Module - Error Code Display on LEDs

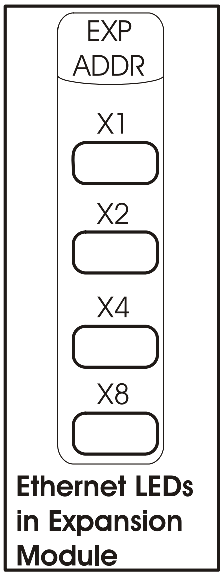
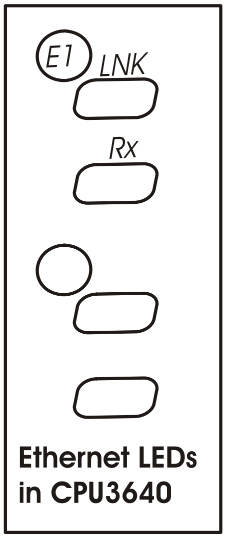
LEDs Location	LED Error Code	Description
	ERR Code 1 ON OFF OFF OFF	Invalid ID in expansion module, or incompatible board type.
	ERR Code 2 OFF ON OFF OFF	Timeout getting discovery response.
	ERR Code 3 ON ON OFF OFF	Failed sending discovery request or getting invalid response.
	ERR Code 4 OFF OFF ON OFF	Failed to configure expansion port.
	ERR Code 5 ON OFF ON OFF	Timeout getting image.
	ERR Code 6 OFF ON ON OFF	Failed to initialize image.
	ERR Code 7 ON ON ON OFF	Timeout initializing expansion module (while getting ready.)
	ERR Code 8 OFF OFF OFF ON	Received illegal file.
	ERR Code 9 ON OFF OFF ON	Failed to burn file.
	ERR Code 10 OFF ON OFF ON	Failed to read local I/O, or to send it to main CPU.
	ERR Code 11 ON ON OFF ON	Failed to send READY or START signal.
	ERR Code 12 OFF OFF ON ON	Timeout getting EMI 'Connect' after EMI was started.
	ERR Code 13 ON OFF ON ON	Failed a few times to send/connect keepalive signal.
	ERR Code 14 OFF ON ON ON	Failed to start EMI or disconnected due to 'fail timeout'.
	ERR Code 15 ON ON ON ON	Other system startup failure.

Table 17-3 Expansion Module – RAM Test Error Code Display on LEDs

LEDs Location	LED Error Code	Description
 The four LEDs begin with the group marked E1, as above.	ERR Code 1 OFF OFF OFF ON	ERR Code 1 = Error in Flash
	ERR Code 4 OFF ON OFF OFF	ERR Code 4 = Unable to boot. Corrupted bootstrap.
	ERR Code 6 OFF ON ON OFF	ERR Code 6 = Low voltage under 12V Where OFF LED = '0'; ON LED = '1' (very fast blink, almost continuous); The highest LED is the most significant.

Expansion Module Specifications

Microprocessor	Freescale – Power PC II, MPC8270, 32-bit
Microprocessor Clock	200 MHz
Serial Port	RS232C Asynch, Full Flow Control port, up to 230.4 kb/s; used for STS only
Ethernet Port	10/100 Mb/s – connection to the main frame
LAN Cable	Category 5E shielded (FTP), up to 50 meter
LEDs Display	4 CPU diagnostic LEDs, Port status LEDs and Expansion Address LEDs
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Operating Voltage	10.8-16 V DC (from the motherboard connector)
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 0.38 Kg (0.84 Lb)

Specifications subject to change without notice.

EXPANSION LAN SWITCH

General Description

The expansion LAN switch provides an interface from the ACE3600 CPU (on the master RTU frame) to up to seven expansion modules (on I/O expansion frames), or up to 13 expansion modules when two switches are used. This enables the use of up to 110 I/O modules. The expansion modules can be co-located with the switch (installed in the same 19” frame or cabinet) or distributed in other locations.

The expansion LAN switch is installed in the main frame only, in either of the first two I/O module slots.

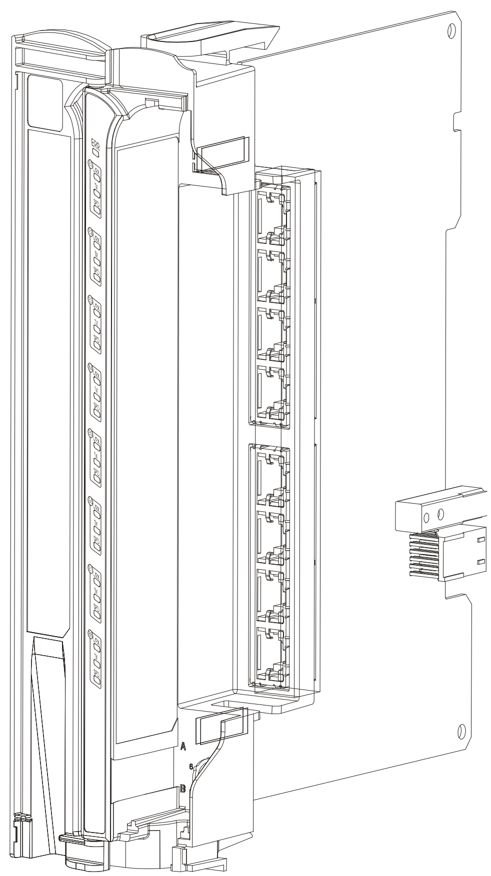


Figure 18-1 Expansion LAN Switch – General View

The front panel includes an Error LED, communication port LEDs, and communication ports. The panel is covered by the module door.

Figure 18-2 provides a detailed view of the expansion LAN switch front panel.

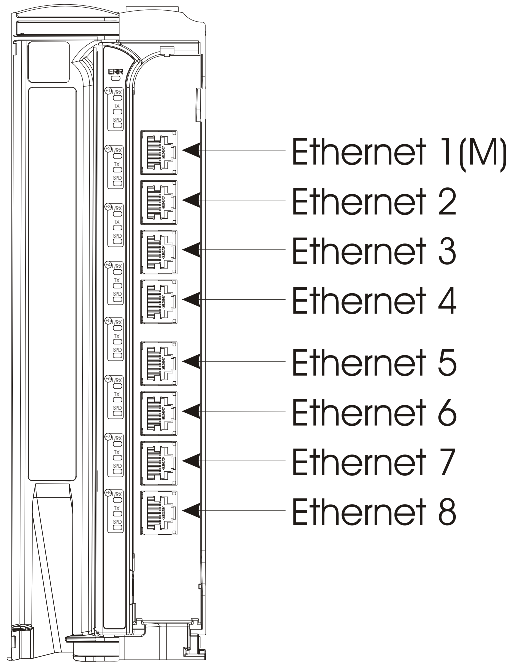


Figure 18-2 Expansion LAN Switch – Front Panel

The ACE3600 expansion LAN switch is configured to prioritize different Ethernet data frame types. A special EMI protocol, used for communication between the expansion LAN switch and the main CPU, quickly collects I/O information from the expansion frames to the main CPU and adds the highest priority and special tags to these Ethernet frames. The switch recognizes these frames and gives them the highest priority in the buffer queue, higher than the frames of the standard protocols (MDLC, TCP/IP) used for communication in the ACE3600 system. For this reason, only the ACE3600 expansion LAN switch can be used in an I/O expansion system.

IMPORTANT

When an expansion LAN switch is used on an I/O expansion LAN, only the main CPU and the expansion frames (expansion modules) can be connected to the expansion switch(es). Any attempt to connect other devices to the expansion switch(es) may result in unpredictable communication delays between the main CPU and the expansion frames and malfunction of the expanded RTU.

Front Panel

Communication Ports

The expansion LAN switch includes eight 100BaseT Ethernet communication ports.

LEDs

The expansion LAN switch includes an error LED and communication port status. All of the LEDs are single color.

Table 18-1 details the LEDs functionality.

Inserting/Removing an Expansion LAN Switch from the Frame

The expansion LAN switch supports hot-swap and can be inserted and extracted while the system is powered up. For instructions on removing/inserting a switch from/into a frame, see the Replacing an I/O Module or Expansion LAN Switch section of the Break-Fix Procedures chapter below.

Note that removing the LAN switch disconnects all I/O modules in the expansion frames connected by LAN. If the expansion frame is disconnected from the main frame for a (configurable) period of time, the expansion module will restart and try to find the main CPU again.

Switch Status and Diagnostics

LAN switch status and diagnostics information can be retrieved via the main CPU using the STS Hardware Test utility. For more details, see the Hardware Test section of the ACE3600 STS User Guide.

Switch Warnings and Errors

LAN switch warnings and errors are logged in the main frame CPU memory. The RTU error logger information can be retrieved using the STS Error Logger utility. For more details, see the Error Logger section of the ACE3600 STS User Guide.

Connecting the Expansion LAN Switch to the Main CPU

Install the expansion in either of the first two I/O module slots in the main frame.

The expansion LAN switch option includes a 0.6 meter Ethernet cable (Motorola p/n FKN8561A). Use this cable to connect from the Eth1 port on the main CPU to the Eth1 (M) port on the expansion switch. For the second switch in a system (if such exists), use this cable to connect from the Eth2 port on first switch to the Eth1 (M) port on the second switch.

Connecting the Expansion LAN Switch to I/O Expansion Frames

Use one of the following Ethernet cables to connect an Ethernet port on the expansion LAN switch to an expansion module in an expansion frame. If the system includes one switch (for up to seven frames), ports Eth2-Eth8 are available. If the system includes two switches (for up to thirteen frames), ports Eth3-Eth8 are available on the first switch and ports Eth2-Eth8 are available on the second switch. Note: The Eth.1 (M) port on the expansion LAN switch is reserved for connection to the main CPU.

Choose the cable length based on the distance from the main frame to the expansion frame.

- 0.6 meter (Motorola p/n FKN8561A) - This cable is used for local connection of the main CPU to the expansion switch, or connection of the first LAN switch to the second, if such exists.
- 2 meter (Motorola p/n FKN8562A)
- 3 meter (Motorola p/n FKN8563A)

IMPORTANT

The main CPU must be connected to the Eth1 (M) port only. If an additional switch is used, the Eth2 port on first switch should be connected to the Eth1 (M) port on the second switch.

No devices or equipment other than the main CPU or expansion modules may be connected to the expansion LAN switch ports.

In systems with several expansion frames, the ACE3600 STS can be used to provide automatic switch connection configuration. The following physical connections are assumed:

- A system with one expansion frame is connected directly to the main CPU.
- A system with 1-7 frames (frame IDs 1-7) is connected via one switch (to expansion LAN switch ports Eth2-Eth8 respectively.)
- A system with 1-13 frames is connected via two switches (frame IDs 1-6 connected to expansion LAN switch 1 ports Eth3-Eth8 respectively and frame IDs 7-13 connected to expansion LAN switch 2 ports Eth2-Eth8 respectively.)

If the expansion frames are not physically connected as described above, the switch connection must be manually configured in the STS Switch Connections dialog. For more information, see the ACE3600 STS User Guide.

Expansion LAN Switch LEDs Behavior

The table below describes the behavior of the LEDs on the expansion LAN switch.

Table 18-1 ACE3600 Expansion LAN Switch LEDs Behavior

LED Name	Description	Status
ERR	Error Logger Status LED Red LED	OFF – No new errors or warnings. Red – New error logged – Either the switch could not configure itself on startup or it has lost communication with the main CPU module. Flashing – FPGA is being loaded into the switch.
E[1-8] L/RX	Ethernet Port [1-8] – Link/RX (receive) Green LED	Flashing – Link is up and Receiving Data. ON – Link is up.
E[1-8] TX	Ethernet Port [1-8] – TX (transmit) Green LED	Flashing or ON – Transmitting Data
E[1-8] SPD	Ethernet Port [1-8] – Speed Green LED	ON – 100MBase-T Ethernet link is up (when L/RX is active). OFF – 10MBase-T Ethernet link is up (when L/RX is active) or no link (when L/RX is not lit). Note: If the speed is not 100M, the system will not perform properly- frames may be lost and the RTU components may not be synchronized.

Expansion LAN Switch Specifications

Ethernet Port 1-8	8 on board 10/100 Mb/s Ethernet ports (Auto crossover)
LEDs Display	Error LED, Port status LEDs
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Module Replacement	Hot swap replacement – module extraction/insertion under voltage
Operating Voltage (from the motherboard connector)	10.8-16 V DC, 3.30 VDC +/-10%
User Connection (Ethernet Ports)	8 shielded RJ45 connectors
LAN Cable	Category 5E shielded (FTP), up to 50 meter
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	Approx. 0.32 Kg (0.7 Lb)

Specifications subject to change without notice.

EXPANSION POWER SUPPLY MODULE

General Description/Module Overview

The expansion power supply module (10.8-16V DC) extends power from the power supply on the RTU's main frame to the I/O expansion frame, or from one I/O expansion frame to another. This module is installed in each I/O expansion frame.

Characteristics of the expansion power supply module:

- Located on the leftmost slot of the frame
- Overvoltage protection for the I/O expansion frame

Figure 19-1 below depicts a general view of the power supply.

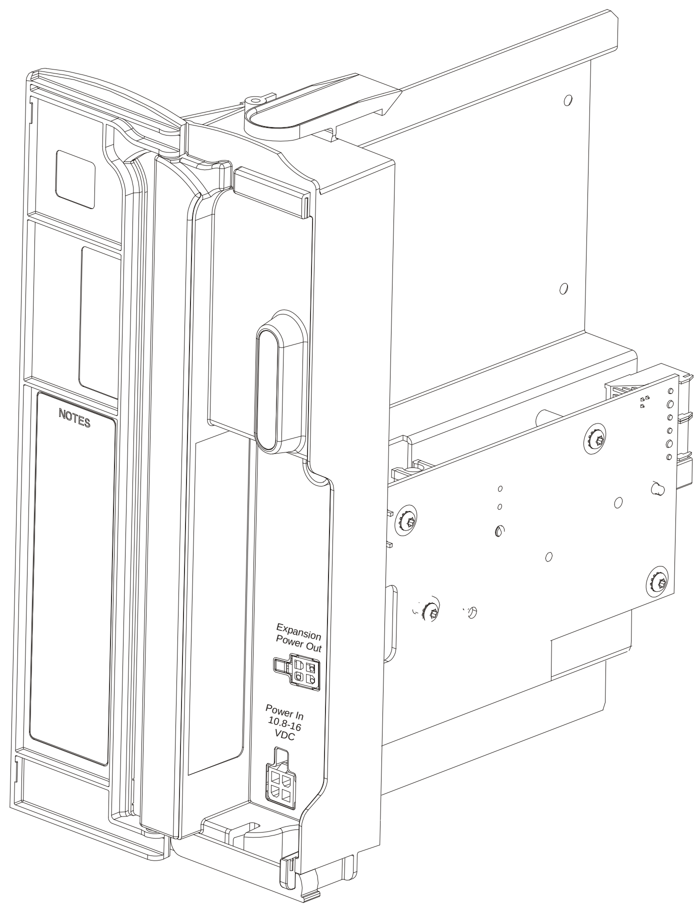


Figure 19-1 ACE3600 Expansion Power Supply – General View

Figure 19-2 below depicts a detailed view of the power supply front panel.

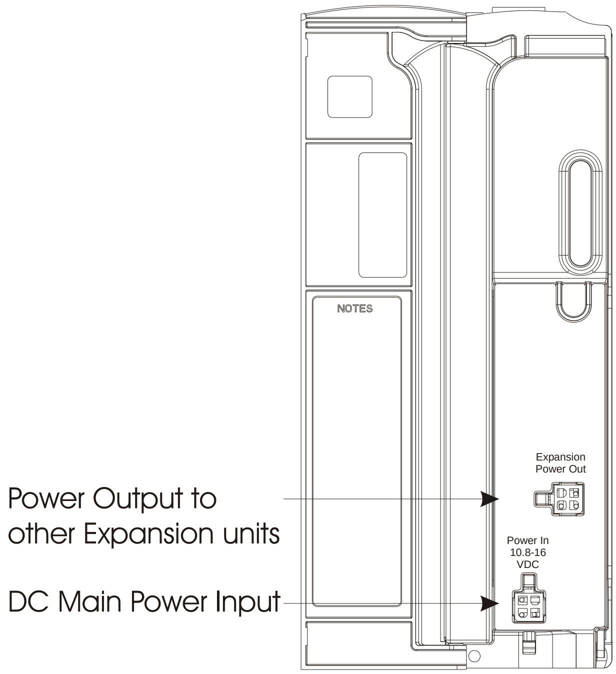


Figure 19-2 ACE3600 Expansion Power Supply – Front Panel

Input/Output Connectors

The front panel of the expansion power supply includes the following connectors.

Connector Name	Description	Notes
Expansion Power Output	DC Power Output Vin=Vout Shorted to Power IN. 10.8-16V DC	This output is used for powering other I/O expansion frames. It also controls a dedicated 12V DO power line that is available to all the slots in the frame to power the relay coils. See the Notes below.

Connector Name	Description	Notes
Power In 10.8-16V DC	Cable inlet for main power cable (DC)	Connect this input to the "RACK EXP" output of a regular power supply or to the "Expansion power out" of an expansion power supply, using a dedicated cable - FKN8559A (3002360C26.) Important: When adding expansion power supplies, make sure that you do not exceed the total power limit of the main power supply, as all connected expansion power supplies drain energy from it. Also make sure that the power provided to each power supply (when connected in a daisy-chain manner) does not fall below the minimum operating voltage. It also controls a dedicated 12V DO power line that is available to all the slots in the frame to power the relay coils. The expansion power supply may be attached via DC cable to the power supply on the previous I/O expansion frame in a daisy-chain manner, or directly to the main power supply. In this case, the 12V DO control on the main power supply can control all DO EE relays in the entire RTU that were configured by dip switch for 12V DO. This enables the user to inhibit all DO EE relays in the entire RTU simply by removing the plug from the 12V DO control in the main power supply.

Module Status and Diagnostics

Detailed module status and diagnostics information can be retrieved via the main CPU using the STS Hardware Test utility. For more details, see the Hardware Test section of the ACE3600 STS User Guide.

Module Warnings and Errors

Power supply module warnings and errors are logged in the main frame CPU memory. The RTU error logger information can be retrieved using the STS Error Logger utility. For more details, see the Error Logger section of the ACE3600 STS User Guide.

Connecting the Expansion Power Supply to the Main Frame Power Supply

The expansion power supply can only be connected to the power supply on the ACE3600 RTU main frame and to other expansion power supply modules.

For instructions on connecting the expansion power supply, see the Connecting the Expansion Power Supply to the Main Frame Power Supply section of the Installation chapter above.

If all the power supplies on I/O expansion frames are attached via DC cable to the power supply on the previous I/O expansion frame in a daisy-chain manner, the main power supply controls the entire RTU. This enables the user to turn off the entire RTU simply by turning off the main power supply.

If the main power supply does not control all other power supplies in the RTU (e.g. when the total power consumption required does not allow all frames to be daisy chained), it is recommended that the main power provided to the power supplies be connected to a single external on/off power switch.

IMPORTANT

All power and ground connections must be in accordance with local standards and laws.

Connecting the Expansion Power Supply to Ground

The power supply on each expansion frame must be connected to the grounding strip of its frame. For important warnings on ground connections, see Connecting Power and Ground in the Installation chapter above.

Connect the terminal ring on the (green/yellow) ground wire of the DC cable (FKN8559A/3002360C26) to the grounding strip located on the frame beneath the power supply slot. Make sure to tighten the screw firmly. See Figure 19-3 below.

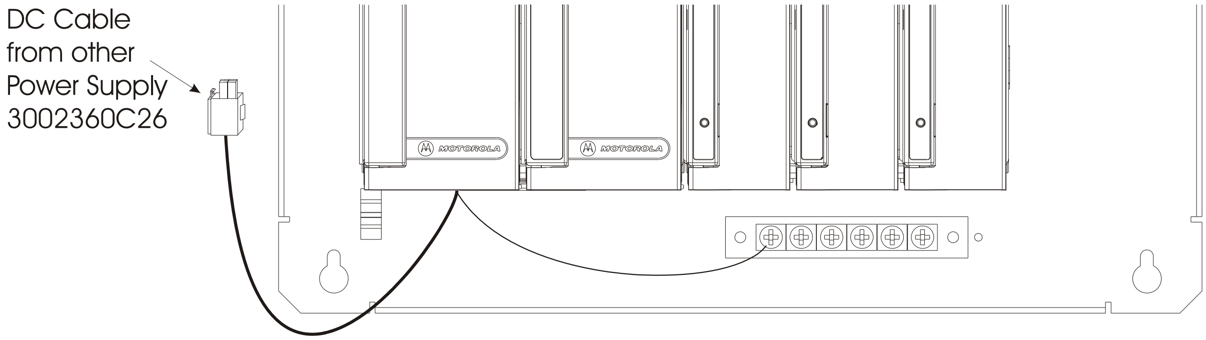


Figure 19-3 ACE3600 Expansion Power Supply – Ground Connection

For instructions on connecting the entire site to ground, see Connecting an RTU to Ground in the Installation chapter above.

Expansion Power Supply Fuses

The expansion power supply includes two slow blow fuses, one 4A fuse for overcurrent protection for the I/O expansion frame and one 8A fuse for maximum current via the Power in/out circuit. See Figure 19-4. For instructions on replacing these fuses, see the Break-Fix Procedures chapter later in this manual.

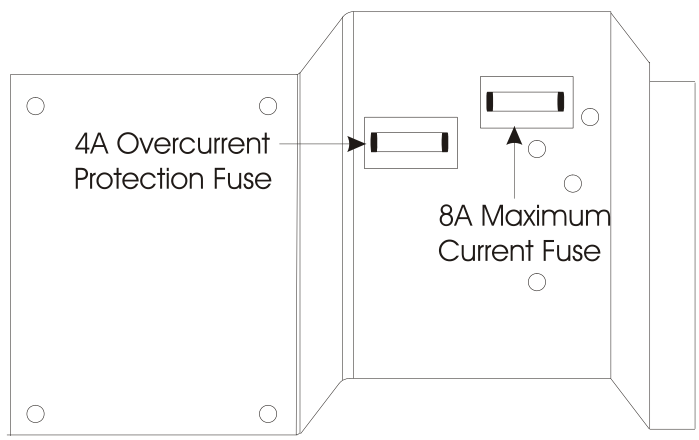


Figure 19-4 ACE3600 Expansion Power Supply – Fuses

Expansion Power Supply Module Specifications

Input Voltage	DC 10.8-16 V
Outputs	To Motherboard connector – +10.80 to +16.00 VDC, max. 4A To cascaded expansion power supply - +10.80 to +16.00 VDC, max. 8A
Over Current Protection	4.0 A (Slow blow fuse), protecting the expansion frame 8.0 A (Slow blow fuse), protecting the cascaded expansion power supply
Maximum Current via Power IN/OUT circuit	8.0 A (Slow blow fuse)
Over Voltage Protection	+17.00 ±1 VDC (protecting the expansion frame)
Absolute Maximum Voltage	+18.00 VDC
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 0.43Kg (0.94 Lb)

Specifications subject to change without notice.

ACE IP GATEWAY MODULE

General Description

The ACE IP Gateway module (CPU 4600) is a Front End Processor (FEP) which enables SCADA control centers to communicate and interface with ACE3600 RTUs and legacy (MOSCAD-M, MOSCAD, and MOSCAD-L) RTUs in a control system. It acts as an interface between the MDLC world and the TCP/IP world.

The ACE IP Gateway (IPGW) supports MDLC connection to multiple RTUs (ACE3600 and legacy MOSCAD RTUs) via terminal server ports from multiple SCADA clients.

Data exchange between the SCADA (client) and the ACE IPGW (server) is carried out using “peer -to-peer” communication over a LAN. SCADA clients can be located on the same TCP/IP segment (location), connected directly to the ACE IPGW, or on different TCP/IP segments (locations), connected to the ACE IPGW via a WAN or a bridge device.

The ACE IP Gateway, like all ACE3600 RTUs supports NTP time synchronization, both as client and as server, MDLC encryption, IP firewall, and dynamic IP conversion table update at run time. The Gateway supports all ACE3600 and MOSCAD RTU data types.

The ACE IP Gateway does not run a user application and does not support I/O modules.

Like the legacy MOSCAD IP Gateway, the ACE IP Gateway supports **redundancy**. The primary and secondary ACE IPGWs share the same site ID. The primary ACE IPGW enables bi-directional transfer of both SCADA application messages and Gateway management messages. The secondary ACE3600 IPGW enables transferring of Gateway management messages only. (It does not send or receive any MDLC messages and is logically disconnected from the link.)

For general information on using the ACE IPGW module, see the ACE IP Gateway section of the ACE3600 STS Advanced Features manual. For instructions on configuring the ACE IPGW module, see the ACE3600 STS User Guide. For information on the ACE IPGW Application Programming Interface (API) used by SCADA driver developers to build the TCP/IP and Ethernet-based ACE IPGW Interface, see the ACE IP Gateway API User Manual.

The ACE IPGW module can be installed on any of the existing ACE3600 chassis options including 19" rack configuration.

Figure 20-1 provides a general view of the ACE IP Gateway Module.

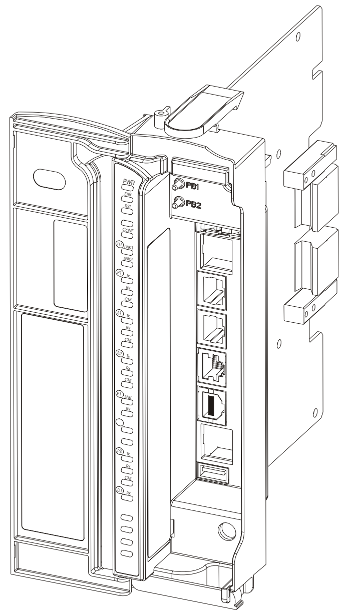


Figure 20-1 ACE IP Gateway Module– General View

The ACE IP Gateway front panel includes status LEDs, communication port LEDs, two pushbuttons, and communication ports. The panel is covered by the module door.

Figure 20-2 provides a detailed view of the ACE IP Gateway front panel.

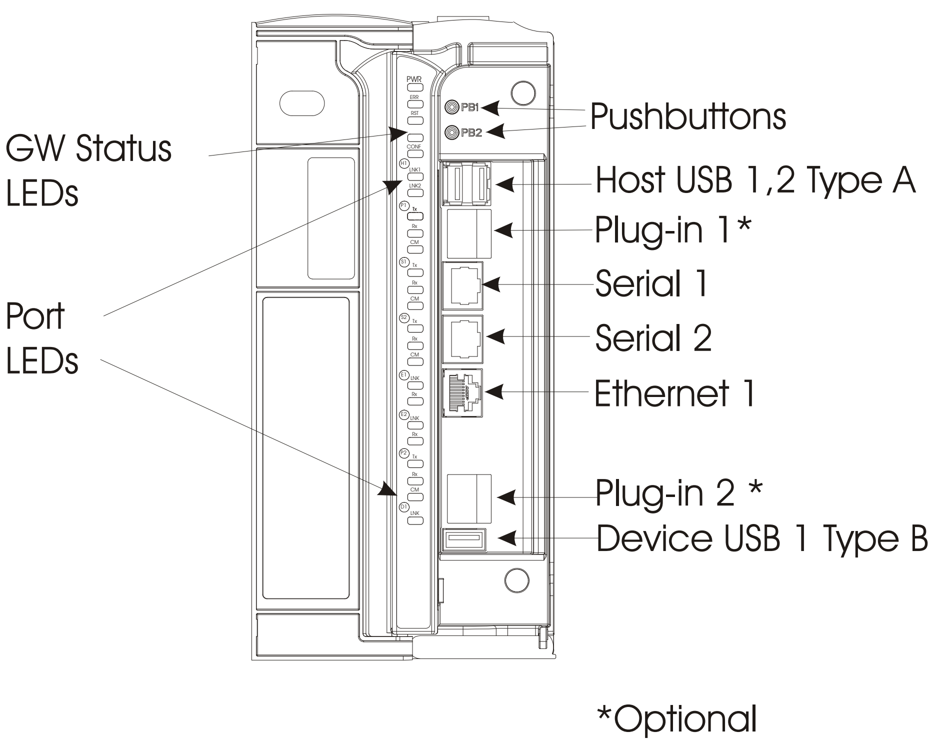


Figure 20-2 ACE IP Gateway Module – Front Panel

Front Panel

Communication Ports

The ACE IP Gateway module includes several communication ports:

On Board ports:

- USB Host 1/2 (HU1/HU2) - USB Type A host full speed ports for MDLC over IP communication via the MotoTrbo digital mode radio system (up to two radios attached to two USB host ports at one time) No USB devices or USB Hubs other than MotoTrbo radios are permitted.
- Serial 1 (SI1) – RS232/RS485 serial port (configurable)
- Serial 2 (SI2) – RS232 serial port
- Ethernet (Eth1) - 10/100BaseT Ethernet port
- DU1 – USB device port, Type B connector (future option)

Plug-in port bays, where different types of ports can be installed:

- Plug-in 1 (PI1) – fits RS232, RS485, 10 MB Ethernet, 10/100 MB Ethernet, or Radio Modem Plug-in option
- Plug-in 2 (PI2) – fits RS232, RS485, 10 MB Ethernet, or Radio Modem Plug-in port option.

For the detailed specifications of each port, see ACE IP Gateway Module Specifications below. For information on the cables and connectors, see Appendix C.

NOTE

The ACE3600 Ethernet port performs an Auto-Negotiation procedure whenever a peer device connection is detected at a 10/100 Mbps Ethernet port. The Auto-Negotiation procedure guarantees that the speeds of ACE3600 and peer Ethernet ports will match, whether or not the peer supports Auto-Negotiation. If the peer supports Auto-Negotiation, the duplex of ACE3600 and the peer Ethernet ports also match.

It is recommended to configure the Ethernet port of the device connected to the ACE3600 Ethernet port (e.g. switch, etc.) to Auto-Negotiation mode. This will guarantee a full match of speed and duplex between the ACE3600 and the peer device Ethernet ports. If the peer device Ethernet port does not support Auto-Negotiation, set the duplex of the peer to half duplex to avoid the duplex mismatch problem.

	Peer Ethernet Port Mode				
	Auto	**100 Mbs Full Duplex**	**100 Mbs Half Duplex**	**10 Mbs Full Duplex**	**10 Mbs Half Duplex**
Speed Match with ACE3600	✓	✓	✓	✓	✓
Duplex Match with ACE3600	✓	✗	✓	✗	✓

Buzzer

The ACE IP Gateway module includes a buzzer (audio indication), which is used to indicate task completion (such as end of download/upload, restart etc.)

Pushbuttons

The Gateway includes two pushbuttons on the front panel, PB1 and PB2.

These pushbuttons are used for activating and testing the modules LED, restarting the unit, erasing the user Flash memory and activating memory test. Table 20-2 describes the pushbuttons functionality.

LEDs

The Gateway includes Gateway CPU status LEDs, and port status LEDs. Some of the LEDs are single color (green) and some are bicolor LEDs (red, green or orange).

Status LEDS indicate the Gateway CPU status in startup (boot), run-time or when there is a failure. The communication LEDs are used to indicate the communication port status. Note that during startup or failure, the communication LEDs are used to indicate various situations. Table 20-4 details the LEDs functionality.

Gateway CPU Memory

The Gateway CPU includes Flash, and SDRAM.

The Flash stores the firmware and configuration files.

The SDRAM memory stores the temporary data.

The size of the ACE IP Gateway CPU memory is determined by the model as shown in the table below.

Table 20-1 ACE IP Gateway CPU Memory

	ACE IP Gateway
Flash memory	32 MB
SDRAM memory:	128 MB
User Flash:	19 MB

Real Time Clock (RTC)

The CPU includes a low drift RTC. The date and time are retained using an on-board rechargeable lithium battery.

The CPU date and time can be set using the ACE3600 STS. The CPU can also be synchronized with other RTUs in the system, using the system clock. For more information, see the Setting/Getting a Site's Date and Time section of the ACE3600 STS User Guide.

Backup Battery for RTC

The CPU module includes a rechargeable lithium battery that provides backup power and data retention for the RTC.

The lithium battery is located on the CPU board and cannot be replaced.

Typically, the battery will retain the RTC for 60 continuous days without power and no Lead-Acid backup battery.

ACE IP Gateway Firmware and Operation Modes

The ACE IP Gateway firmware is a real-time multitasking operating system, based on the Wind River VxWorks OS. The GW shipped from the factory with the most recent firmware version, and it can be updated/replaced using a remote or local connection. Downloading firmware updates is performed using the STS. (See Downloading to a Site in the ACE3600 STS manual.) If the new firmware download stops or fails, the GW will restart with the existing firmware.

Power-up and Restart

The CPU requires DC voltage provided by the power supply module via the motherboard (when the PS switch is ON). The CPU will power-up and restart in the range of 10.8V to 16V DC. During power-up, the processor performs fast memory tests, and initiates the GW. The end of the power-up sequence is indicated by the buzzer. The length of time from the beginning of CPU power-up until the GW starts running is approximately 10-15 seconds.

It is possible to perform a comprehensive memory test during power-up by pressing push-button PB1 for few seconds while switching the power supply from OFF to ON. In this case the power-up period is about 30-35 seconds long.

If the startup fails, the RTU will freeze (boot sequence stops), the PWR LED will blink and the four indicator LEDs (see LEDs Location in Table 20-3) will blink seven times. The four LEDs will then display the failure error in binary code, as described in Table 20-3.

When the unit is shipped from the factory, it will start up initially (before site configuration download), as a Primary Gateway in Standalone mode, even in systems with redundant Gateways.

Restart after Firmware Download

The RTU will restart after downloading system firmware. If the firmware is faulty or the firmware download failed, the RTU, if protected by the Safe Firmware Download feature, will restart and roll back to the previous firmware version. A failure message will appear in the STS Downloader screen. For information on using the Safe Firmware Download feature, see the Safe Firmware Download section of the ACE3600 STS Advanced Features manual.

Restart after Configuration Download

The RTU will restart after downloading a site configuration. For information on downloading to the RTU, see the Operation chapter of the ACE3600 STS User Guide.

If the RTU fails to restart after the user-defined site configuration was downloaded, a unique LED display (in the range of the PI1-TX and SI2-RX LEDs) and a series of buzzer tones will follow. The RST LED will turn RED and the RTU will restart itself with the previous "good" configuration. The following message will appear in the RTU Error Logger "Configuration file was deleted due to failure in startup. Rolling back to the last configuration file". Errors can be retrieved from the RTU using the ACE3600 STS Error Logger utility.

If the startup succeeds after configuration download but has errors, these errors are reported in the RTU Error Logger. It is, therefore, recommended to check for errors after downloading a configuration file to the RTU. Errors can be retrieved from the RTU using the ACE3600 STS Error Logger utility.

For information on retrieving errors from the RTU Error Logger, see the Operation chapter of the ACE3600 STS User Guide.

In a system with redundant Gateways, one unit is set to startup mode Redundant GW1 (in the site configuration) and the other unit which is set to Redundant GW2. After startup, both will act as Secondary Gateways until the SCADA designates one as Primary and the other as Secondary. For information on the setting the startup mode, see the Operation chapter of the ACE3600 STS User Guide. For information on ACE IPGW redundancy, see the ACE IP Gateway section of the ACE3600 STS Advanced Features manual.

Restart after Erase Flash

After the User Flash is erased, the RTU will restart successfully with the default site configuration.

Power-down

When the voltage provided to the CPU module drops below the minimum level, the CPU will shut down in an orderly fashion. This level is configurable for all power supply modules other than the 12V DC power supply low-tier. See the 'Minimum DC operation voltage' parameter in Appendix A: Site Configuration Parameters of the ACE3600 STS User Guide.

ACE IP Gateway Status and Diagnostics

The ACE IP Gateway status is indicated on the front panel LED. Detailed CPU status and diagnostics information can be retrieved from the module using the CPU Hardware Test utility. For more details, see the Hardware Test section of the ACE3600 STS User Guide.

ACE IP Gateway Warnings and Errors

ACE IP Gateway warnings and errors are logged in the CPU memory to indicate issues or errors during power-up, restart, and other modes of CPU operation. The existence of CPU warnings and errors are indicated in the ERR LED on the front panel of the module. Green indicates a message, orange indicates a warning and red indicates an error.

The CPU error logger information can be retrieved using the STS Error Logger utility. For more details, see the Error Logger section of the ACE3600 STS User Guide.

ACE IP Gateway Serial Number

Each IPGW has a unique serial number. This number is printed on a label on the side of the GW module front panel. The serial number can be read using the STS Hardware. For more information, see the Hardware Test section of the ACE3600 STS User Guide.

Pushbutton Functionality

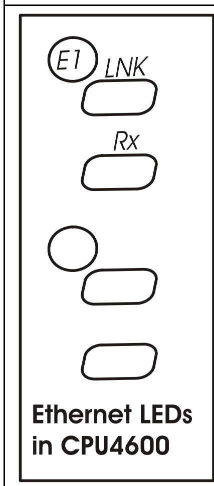
The table below describes the use of the two pushbuttons in various scenarios, during power-up and run-time. To press a pushbutton during startup, first press the pushbutton(s), then turn on the RTU using the On/Off switch on the front panel. Keep the pushbutton(s) depressed for the required number of seconds, as specified in the scenarios below.

Table 20-2 ACE IP GW Pushbutton Functionality

Scenario	Trigger	Action
LEDs Test	During run-time, press PB1 for five or more consecutive seconds (but less than 30).	All the LEDS on the GW will be lit until let go of PB1 and then returned to their previous states.
RTU Restart	During run-time, press PB1 for 30 consecutive seconds.	All the LEDs will be lit. Then all the LEDs will blink once. The buzzer will buzz several short beeps. (If PB1 is released during this time the restart will not be performed.) At the long beep, release PB1 and the RTU will restart (and the buzzer will buzz.)
Turn LEDs ON	During run-time, press PB1 for one second.	Those LEDs which are currently active will be turned on for a period of time (configured in the RTU configuration using the STS.)
RAM Test	During startup, press PB1.	A detailed memory test of SDRAM is performed. - At the beginning of the RAM test, the four indicator LEDs (see LEDs Location in Table 20-3) will blink three times. During the RAM test, the LEDs may blink or be lit. If the RAM test succeeds, the four LEDs will blink three times and turn off and the restart sequence will continue. If the RAM test fails, the RTU will freeze (restart sequence stops), the PWR LED will blink and the four LEDs will blink seven times. The failure error code will then be displayed on the LEDs, in binary code, as described in Table 20-3. - To exit/abort the RAM test in the middle, restart the RTU using the On/Off switch on the front panel.

Scenario	Trigger	Action
Erase User Flash	During startup, press both PB1 and PB2 simultaneously until the buzzer buzzes five times quickly, then continuously for three seconds.	All the user Flash memory content excluding logging files (files tagged as data logging files) is erased, including the site configuration, etc.
Bootstrap	During startup, press PB2 continuously for five seconds. Note: Before initiating bootstrap, the CPU must be connected directly to the STS PC in standalone mode. No other components can be on the network which might create a conflict with the default IP address.	The RTU will start up in diagnostic mode. Communication with the RTU is for diagnostic purposes only (Error Logger/ SW Diagnostics.) You cannot download to the RTU. If the bootstrap fails, the four indicator LEDs (see LEDs Location in Table 20-3) will display the failure error in binary code, as described in Table 20-3.

Table 20-3 ACE IP GW Failure – Error Code Display on LEDs

LEDs Location	LED Error Code	Description
	ERR Code 1 OFF OFF OFF ON	ERR Code 1 = Error in Flash
	ERR Code 2 OFF OFF ON OFF	ERR Code 2 = Error in SDRAM
	ERR Code 4 OFF ON OFF OFF	ERR Code 4 = Unable to boot. Corrupted bootstrap.
	ERR Code 6 OFF ON ON OFF	ERR Code 6 = Low voltage under 12V
On the ACE IP GW, the four LEDs begin with the group marked E1, as above.		Where OFF LED = ‘0’; ON LED = ‘1’ (very fast blink, almost continuous); The highest LED is the most significant.

ACE IP Gateway LEDs Behavior

The table below describes the behavior of the LEDs on the ACE IP Gateway module.

Table 20-4 ACE IP Gateway LEDs Behavior

LED Name	Description	Status
PWR	Power LED Bicolor LED (Red, Green)	Flashing Red – Power exists; CPU FPGA not loaded. Green – Power exists; CPU is running from a recognized power supply (one of the six power supply options.) Red – Failure on power-up. CPU is running from an unrecognized power supply.
ERR	Error Logger Status LED Bicolor LED (Red, Green)	OFF – No new errors or warnings. Green – New message logged. Orange – New warning logged. Red – New error logged.
RST	Reset LED Bicolor LED (Red, Green)	Green – On startup OFF – Successful power-up or restart. Red – Power-up or restart failed.
CONF	Configuration LED Bicolor LED (Red, Green)	OFF – Configuration was not loaded. Green – Configuration was loaded. Red – Configuration error.
H1 LNK1	USB Host1 LNK (link) Green LED	ON – A USB device is connected. OFF – No link exists between the CPU and the device.
H1 LNK2	USB Host2 LNK (link) Green LED	ON – A USB device is connected. OFF – No link exists between the GW and the device.
PI1 TX	Plug-in Port 1 – TX (transmit) Green LED	ON- Transmitting Data
PI1 RX	Plug-in Port 1– RX (receive) Green LED	ON – Receiving Data

LED Name	Description	Status
PI1 CM	Plug-in Port 1 – CM (channel monitor) Green LED	ON – Channel Busy (if port is in use by radio, RS485, or RS232) – Network Connected (if an IP plug-in is used)
SI1 TX	Serial Port 1 – TX (transmit) Green LED	ON – Transmitting Data
SI1 RX	Serial Port 1 – RX (receive) Green LED	ON – Receiving Data
SI1 CM	Serial Port 1 – CM (channel monitor) Green LED	ON – Channel Monitor is ON.
S2 TX	Serial Port 2 – TX (transmit) Green LED	ON – Transmitting Data
S2 RX	Serial Port 2 – RX (receive) Green LED	ON – Receiving Data
S2 CM	Serial Port 2 – CM (channel monitor) Green LED	ON – Channel Monitor is ON
E1 LNK	Ethernet Port 1 (link) Green LED	ON – Network Connected In case of RAM test and startup failure, see Table 20-2 and Table 20-3.
E1 RX	Ethernet Port 1 (receive) Green LED	ON – Receiving Data In case of RAM test and startup failure, see Table 20-2 and Table 20-3.
PI2 TX	Plug-in Port 2 – TX (transmit) Green LED	ON – Transmitting Data
PI2 RX	Plug-in Port 2 – RX (receive) Green LED	ON – Receiving Data
PI2 CM	Plug-in Port 2 – CM (channel monitor) Green LED	ON – Channel Busy (if port is in use by radio, RS485, or RS232) – Network Connected (if an IP plug-in is used)
D1 RX	For future use	For future use

ACE IP Gateway Module Specifications

Microprocessor	Freescale – Power PC II MPC8270, 32-bit, extended communication capability, DMA and floating point calculation support
Microprocessor Clock	200 MHz
Memory	Flash: 32 MB SDRAM: 128 MB
Real-Time Clock	Full calendar with leap year support (year, month, day, hours, minutes, seconds). Time drift: max. 2.5 Seconds per day (when power is on)
RTC Retention	3 V Rechargeable lithium backup battery
Serial Port 1	Configurable RS232 or RS485 port: - RS232: Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS485, multi-drop 2-Wire up to 230.4 kb/s
Serial Port 2	RS232, Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface
Plug-In Port 1	Supports the following plug-in ports: - Radio Modem, DPSK 1.2 kb/s, FSK 1.2/1.8/2.4 kb/s, DFM 2.4/3.6/4.8 kb/s - RS232, Sync/Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS485, multi-drop 2-Wire up to 230.4 kb/s - Ethernet 10/100 Mb/s
Plug-In Port 2	Supports the following plug-in ports: - Radio Modem, DPSK 1.2 kb/s, FSK 1.2/1.8/2.4 kb/s, DFM 2.4/3.6/4.8 kb/s - RS232, Sync/Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS485, multi-drop 2-Wire up to 230.4 kb/s - Ethernet 10 Mb/s
USB Host Port 1, 2	Type A host full speed 12 Mbs ports (HU1 on left and HU2 on right) for MDLC over IP communication via the MotoTrbo digital mode radio system
USB Device Port 1	USB Device port (for future use)
LEDs Display	4 CPU diagnostic LEDs and Port status LEDs
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Operating Voltage	10.8-16 V DC (from the motherboard connector)
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 0.38 Kg (0.84 Lb)

Specifications subject to change without notice.

RADIO TYPES AND INSTALLATION KITS

ACE3600 Radio Types

CAUTION

In order to prevent overheating of the radio and degradation of radio performance, the radio should not exceed operating duty factors of 30% transmission and 70% receive mode.

Note that the operating temperature range of ACE3600 RTU models that include a radio is from -30 ºC to +60 ºC (-22 ºF to +140 ºF). (The operating temperature range of the ACE3600 RTU models without a radio is from -40 ºC to +70 ºC (-40 ºF to +158 ºF)).

The ACE3600 RTU supports conventional, analog trunked radios and digital trunked radios. It also supports data radios and various wireless modems. Conventional and analog trunked radios are connected to a plug-in radio modem port. Digital trunked radios and wireless modems are connected to an RS232 port. For information on configuring CPU ports for various radios/modems, see the ACE3600 STS User Guide. For information on IP communications over such modems, see the ACE3600 STS Advanced Features manual.

The following conventional/trunked mobile analog and digital radios and conventional portable analog and digital radios can be used with the ACE3600 RTU:

	Analog Motorola Radios	Digital Motorola Radios	Third Party Radios
Trunked	XTL5000[*]/XTL2500	XTL5000/XTL2500	
		XTS2500	
		MTM800	
Conventional	CM200/CM140/EM200/ GM3188		MDS 9810/MDS 4710/ MDS 9710
	GP320/GP328/HT750/ PRO5150		TransNET 900™[**] OEM
	CDM750		iNET 900™
	XTL500/XTL2500		

[*] XTL5000 Radio with O5 Control Head is not available.

[**] TransNET 900 and iNET 900 are trademarks of GE MDS.

MotoTrbo	XPR4350/XPR4380/ DM3400/ XiR M8220/DGM4100

For complete radio specifications such as modulations, standards, Tx power output, Rx sensitivity, supply voltage, and power consumption, see the specific radio owner's manual. Please note that third party radios are not provided with the RTUs.

The following table lists all the ACE3600 models that include radios.

Conventional VHF Radio	**ACE3600 Model**
ACE3600 for CM200/CM140/EM200/GM3188 VHF	F7573A
ACE3600 with CDM750 136-174 MHz	F7563A
ACE3600 for HT750/GP320/GP328 /PRO5150 VHF	F7553A
Conventional UHF Radio	
ACE3600 for CM200/CM140/EM200/GM3188 UHF	F7574A
ACE3600 with CDM750 403-512 MHz	F7564A
ACE3600 for HT750/GP320/GP328 /PRO5150 UHF	F7554A
Trunked VHF Radio	
ACE3600 with XTL2500 136-174 MHz Analog	F7533A
ACE3600 with XTL2500 136-174 MHz Digital	F7593A
ACE3600 with XTS2500 136-174 MHz Digital	F7543A
Trunked UHF Radio	
ACE3600 with XTL2500 380-520 MHz Analog	F7534A
ACE3600 with XTL2500 380-520 MHz Digital	F7594A
ACE3600 with XTS2500 380-520 MHz Digital	F7544A
Trunked 800MHz Radio	
ACE3600 with XTL2500 800MHz Analog	F7538A
ACE3600 with XTL2500 800MHz Digital	F7598A
ACE3600 with XTS2500 800 MHz Digital	F7548A
MotoTrbo Digital* Mobile Radio	
ACE3600 for XPR4350/DM3400/XiR M8220/DGM4100 VHF	F7583A
ACE3600 for XPR4350/DM3400/XiR M8220/DGM4100 UHF	F7584A
ACE3600 for XPR4380 800/900 MHZ	F7588A

* Note that the MotoTurbo radios can work as conventional analog radios or as digital radios. ACE3600 supports the digital mode only.

For a list of the radio models and regional options for the CM/EM/GM radios, see CM/EM/GM Radio Models and Regional Options for ACE3600 below. For a list of the radio models and regional options for the GP/HT/PRO radios, see GP/HT/PRO Radio Models and Regional Options for ACE3600 below. For a list of the regional options for the MotoTrb radios, see XPR4350/XPR4380/DM3400/XiR M8220/DGM4100 Options for ACE3600 below.

IMPORTANT: Only model F7509A and all its options, including radio installation kits, may be shipped to European Union (EU) countries. The installer must confirm that there are no emissions or harmful interference to the spectrum due integrating the radio into this model.

The radios in the models listed in the table above are installed on the RTU using the installation radio kits described below.

Radio Installation Kits

The following radio installation kits enable the user to install a radio in the ACE3600 RTU.

					Option/Kit
Analog Conventional Mobile Radios	CDM750				V143AH/ FLN3638A
	NA	**EMEA**	**APAC**	**LA**	
	CM200	CM140	GM3188	EM200	V148AC/ FLN3635A
Digital Conventional Mobile Radios	MDS 9810, MDS 4710, MDS 9710				V152AK/ FLN3853A
	TransNET 900 OEM				VA00225AA/ FLN3852A
	iNET 900				V680AH/ FLN3854A
Conventional Portable Radios	**NA**	**EMEA**	**APAC**	**LA**	
	HT750	GP320	GP328	PRO5150	V154AE/ FLN3637A
Analog Trunking Mobile Radios	XTL5000/XTL2500				V157AB/ FLN3640A
Digital Trunking Mobile Radios	XTL5000/XTL2500				V681AT/ FLN3649A
	XTS2500				V156AG/ FLN3814A
	MTM800				FLN4109A
MotoTrbo Mobile Radios	**NA**	**EMEA**	**APAC**	**LA**	
	XPR4350/ XPR4380	DM3400	XiR M8220	DGM4100	V682AF/ FLN4102A

For instructions on mounting the radio on the ACE3600 frame, see the desired installation instructions below.

For general instructions on mounting a radio on the wall, see Mounting the ACE3600 Radios on a Wall below.

Note: A TORX screwdriver is required for the installation kits.

XTL5000/XTL2500 Radio Installation Kit

The XTL5000/XTL2500 radio installation kit (ACE3600 option V681AT or V157AB) enables the user to install the XTL5000/XTL2500 radio in ACE3600 Remote Terminal Units (RTU). The ACE3600 can use the XTL5000/XTL2500 in two operation modes, depending on the system used.

- Digital mode (ACE3600 option V681AT) - suitable for Astro 6.x/7.x system trunked ASTRO IV&D only
- Analog mode (ACE3600 option V157AB) - suitable for SmartNet 3.x system or Astro 4.x system (on the analog part only)

The following hardware and firmware are required:

- Radio firmware version 6.3E and above for digital trunked ASTRO IV&D. (For 6.3E, HOST R04.51.01 DSP R04.50.00; for 6.5 HOST R05.00.00 and DSP R05.00.00)
- Radio firmware version 6.5E and above for analog trunked system (DSP version R06.00.00 for radio firmware R06.01.00)
- ASTRO Infrastructure version SR6.3 and above for trunked ASTRO IV&D
- Smartnet version 3.x or Astro version 4.x for analog trunked system
- ACE3600 firmware 10.00 and above
- ACE3600 System Tools Suite (STS) version 10.50 and above

The FLN3649A/FLN3640A installation kits include a bracket, cables, and screws.

IMPORTANT: The XTL5000/XTL2500 radio control head must be radio option O5 for revolving power button control head.

Installation

The XTL5000/XTL2500 radio can be mounted on the ACE3600 RTU using the metal bracket and cables as follows:

Procedure 21-1 How to Install the XTL5000/XTL2500 Radio on the Metal Chassis

1. Attach the radio plug-in port from the installation kit (FLN3696A) to the desired opening on the ACE3600 CPU module. For instructions on attaching plug-in ports, see Connecting Plug-In Ports to the CPU Module in the CPU Module chapter above.
2. Attach the XTL5000/XTL2500 radio to the metal bracket (#0789422V41 from FHN6895A) using the four supplied radio screws (#0310906A67), two on each side. (See Figure 21-1.) The wider side of the bracket should be on the right side of the radio (closer to the knobs.)
3. Connect the 26-pin connector of the signal cable (FKN8432A for digital mode or FKN8438A for analog mode) to the Accessory connector on the radio. In analog mode only, place one Fair-Rite soft ferrite (#7683477X01 from the supplied ferrite kit

FHN7007A) on the signal cable (FKN8438A) near the bottom of the CPU door, loop the cable one turn around it, and clamp the ferrite on the cable.
Connect the other end of the communication cable to the ACE3600 CPU module port configured for the radio. (See Figure 21-2 and Figure 21-4.) For digital mode use any of the serial on-board or plug-in ports. For analog mode only the plug-in ports may be used. See RTU Port Configuration for the Astro IV&D Digital Radio and RTU Port Configuration for the Astro IV&D Analog Trunked Radio below.

4. Connect the DC power cable (FKN8436A) to the Power connector on the radio and the free red wire to the ignition pin on the FKN8432A/FKN8438A cable. Connect the opposite end of the power cable to the AUX2A or AUX2B connector on the ACE3600 power supply unit. (See Figure 21-2 and Figure 21-4.)

Figure 21-1 XTL5000/XTL2500 Radio and Metal Bracket

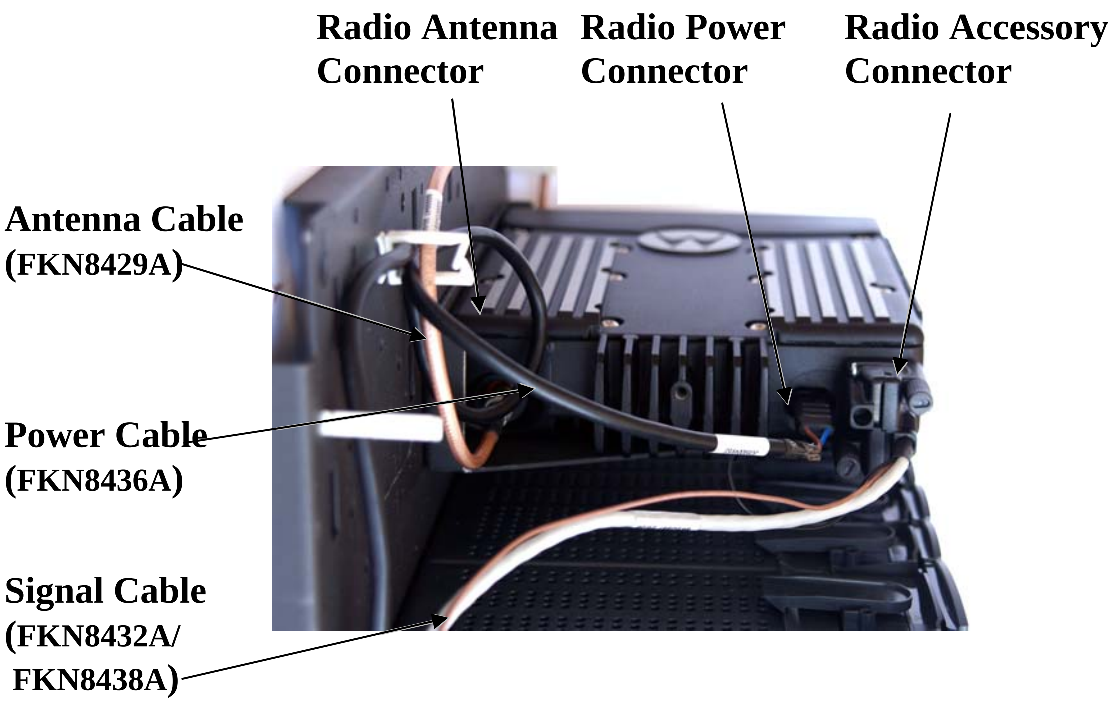


Figure 21-2 XTL5000/XTL2500 Radio Cable Connections- Rear View

5. Mount the bracket on the RTU chassis above the CPU and I/O modules, using the four built-in screws. (See Figure 21-4.) The wider side of the bracket is attached to the chassis.

6. Connect the antenna cable (FKN8429A) to the Antenna connector on the radio. Run the cable through the small white clips along the edge of the chassis and attach the connector to the opening on the bottom of the ACE3600 RTU housing. (See Figure 21-2 and Figure 21-4.)

Figure 21-3 XTL5000/XTL2500 Radio Bracket with Four Bracket Mounting Screws

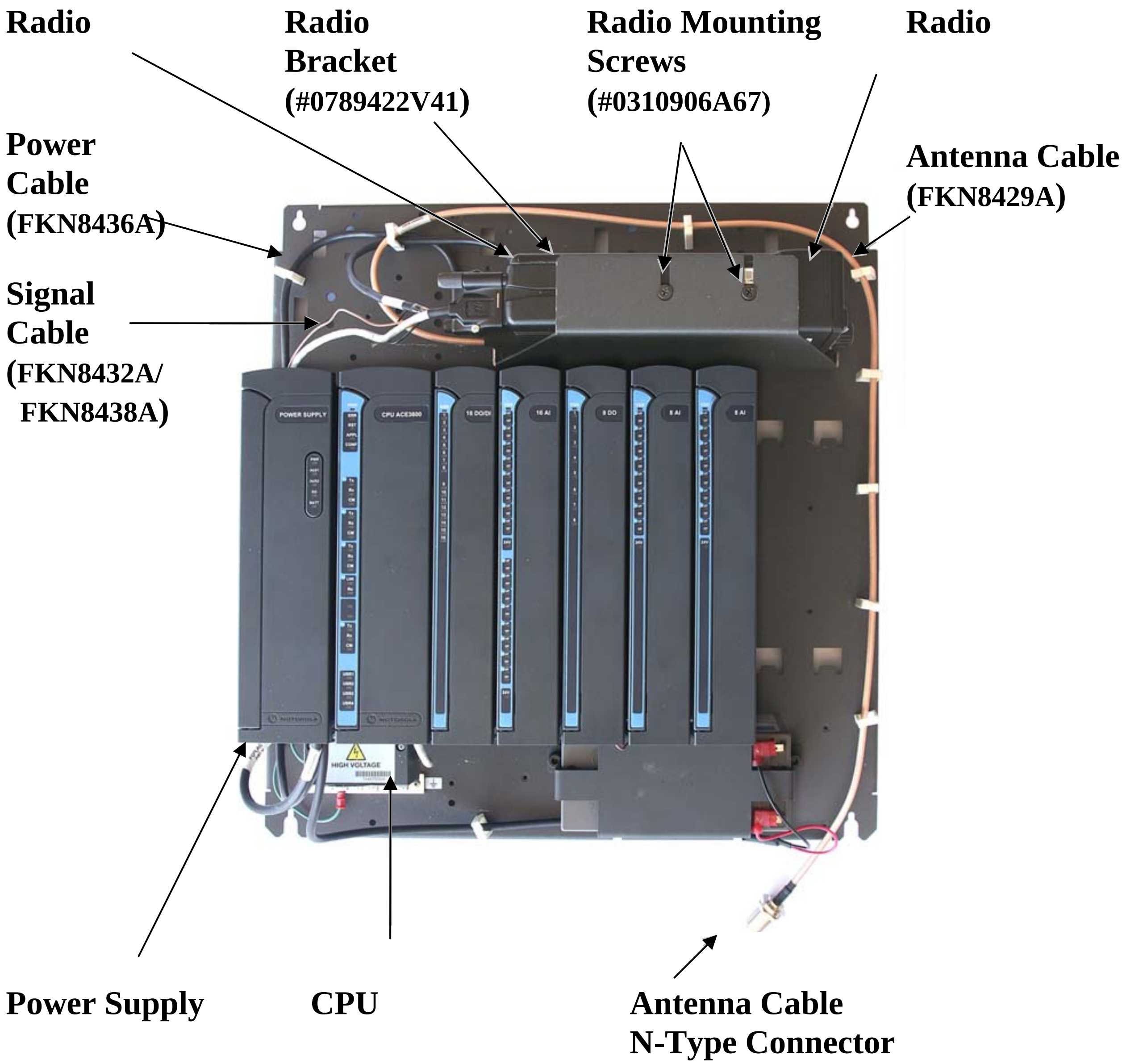


Figure 21-4 XTL5000/XTL2500 Radio Installed on ACE3600 Chassis

RTU Port Configuration for the Astro IV&D Digital Radio

To enable MDLC communication using Astro XTL5000/XTL2500 radios, use the ACE3600 STS site configuration utility to configure the ACE3600 RTU port connected to the radio. For more information, refer to the IP Communications chapter of the ACE3600 STS Advanced Features manual.

The following figures show the port configuration and advanced parameter configuration. Although these show Port SI1, the same values can be applied to other ports, where relevant.

Port Type (for Astro IV&D Digital Radio)

Procedure 21-2 How to Configure the ACE3600 Port for the Astro IV&D Digital Radio

1. In the ACE3600 STS click on the desired site, and open the site view.
2. In the Port Tab, click on the on-board or plug-in port through which the RTU will communicate with the XTL5000/XTL2500 radio.
3. Confirm that the port parameters and data speed are as shown in the screen below.
4. Define desired links.
5. If you plan to synchronize the RTU time from the Front End Processor (FEP) in the Customer Enterprise Network (CEN), specify the IP address of the FEP in the NTP field. This IP address information is provided by your ASTRO IV&D system operator.
6. Save the changes.

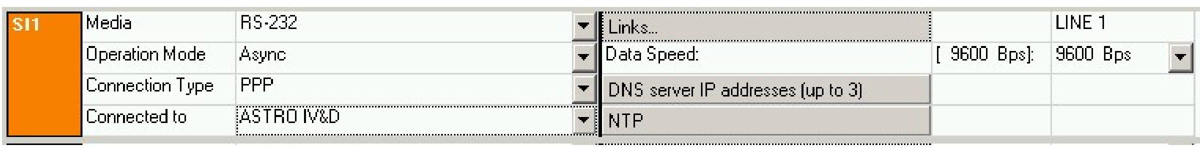


Figure 21-5 RTU Site Configuration for MDLC over ASTRO IV&D – Port Type Parameters

Advanced Parameter Configuration (for Astro IV&D Digital Radio)

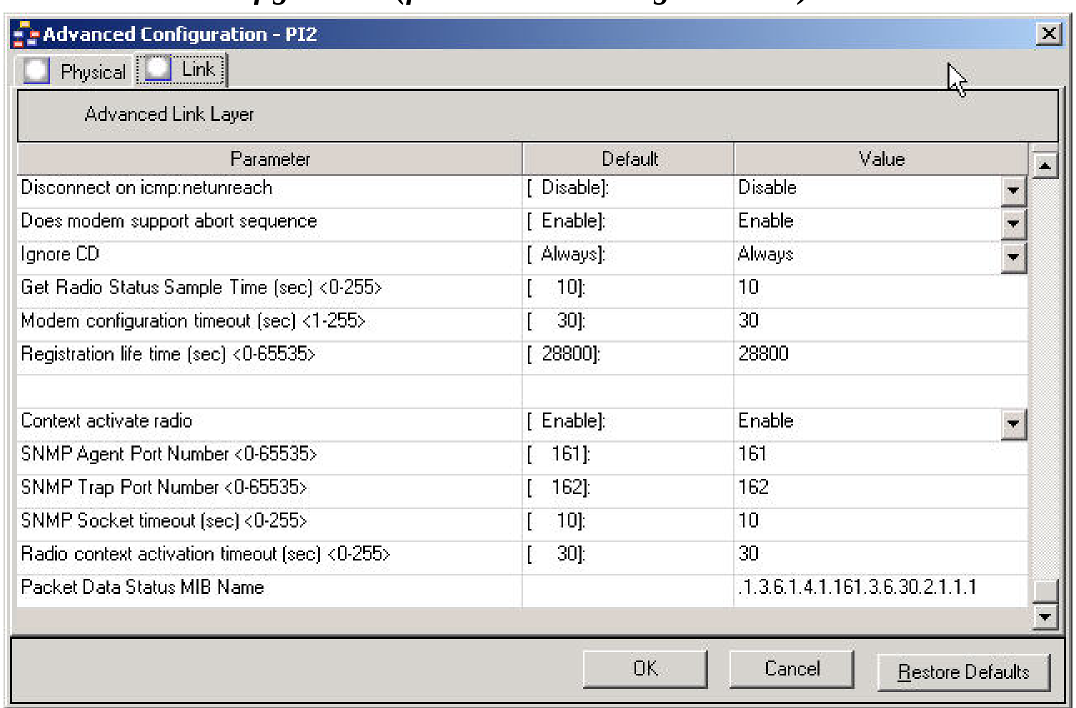


Figure 21-6 RTU Site Configuration for MDLC over ASTRO IV&D – Advanced Parameters

Generally no other changes are required to Advanced Physical or Link Layer parameters. For information on these parameters, see the MDLC over IP chapter of the ACE3600 STS Advanced Features manual.

Procedure 21-3 How to Configure the Advanced Parameters of the ACE3600 Port for the Astro IV&D Digital Radio

1. (ASTRO System 6.3-6.5 only) Make sure that the Advanced Link parameter Registration life time to 28800 seconds (default) in order to restart the radio periodically.

2. If any changes are required, click on the appropriate screen in the Port Tab.

3. Change the settings as necessary.
   Note: The Default Group ID Address should be left 000.000.000. The actual values will be read by the RTU from the radio upon connection.

4. Save any changes.

5. Save the project.

6. Download the site configuration to the ACE3600 RTU.

IP Conversion Table (for Astro IV&D Digital Radio)

Prepare an IP conversion table if the RTU must communicate with another RTU or an IP Gateway. In the IP conversion table, specify the IP address of each RTU port (site ID + link ID). This IP address is assigned by the infrastructure operator.

Note that an IP address is obtained from the radio once it is connected to the RTU port over PPP. The IP address obtained from the radio is not the real IP address set by the infrastructure, but rather a dummy address. This dummy is configured in the radio via the CPS Mobile Computer IP address parameter (by default 192.168.128.2).

When device LINxL level 0 is retrieved using the ACE3600 STS Software Diagnostics tool, the IP Address displayed is this dummy address and not the actual IP address assigned by the infrastructure operator.

It is recommended to create two IP conversion tables:

1. The first is downloaded to the FIU or IP Gateway on the LAN and includes the site and IP information for each RTU.

2. The second is downloaded to all RTUs which are connected to the infrastructure with ASTRO IV&D radios, and includes the site and IP information for the FIU and IP Gateway.

For detailed instructions on preparing the IP conversion table, refer to the IP Communications chapter of the ACE3600 STS Advanced Features manual.

Programming the Astro IV&D Digital Radio using CPS

The XTL5000/XTL2500 radio is programmed for ACE3600 in the factory and is ready for ASTRO IV&D communication. For user programming of site-specific parameters, the radio should be brought to the Motorola Service Center.

Radio Connections

To program the XTL5000/XTL2500 radio with Customer Programming Software (CPS), the radio must be connected to a PC.

Procedure 21-4 How to Connect the XTL5000/XTL2500 Radio to the CPS

1. Connect one end of the programming cable (HKN6155) to the microphone connector on the front of the radio. This cable is not supplied and must be ordered separately.

2. Connect the other end to the serial port of a PC on which the ASTRO CPS software (RVN4185) is installed.

Radio Disassembly

If the XTL5000/XTL2500 radio is to be programmed outside of the ACE3600 housing, disassemble the radio as follows:

Procedure 21-5 How to Disassemble the XTL5000/XTL2500 Radio from the ACE3600 Metal Chassis

1. Disconnect the antenna cable (FKN8429A) from the Antenna connector on the radio.

2. Remove the radio/bracket unit from the RTU chassis by unscrewing the four built-in screws.

3. Disconnect the DC power cable (FKN8436A) from the Power connector on the radio.

4. Disconnect the 26-pin connector of the signal cable (FKN8432A/FKN8438A) from the Accessory connector on the radio.

5. Detach the metal bracket (#0789422V41 from FHN6895A) by unscrewing the four radio screws (#0310906A67), two on each side. (See Figure 21-1.)

6. Take the radio to a laboratory for programming, as described in CPS Programming Settings below.

CPS Programming Settings

Before programming the radio, read the codeplug file from the radio and save it to your PC using the File >Read Device command in the CPS (R04.01.01 for radio firmware 6.3E; R05.00.00 for firmware 6.5). Open the codeplug file in the CPS and set the parameters as follows.

Procedure 21-6 How to Program the XTL5000/XTL2500 Digital Radio

1. In the CPS, click on the codeplug in the tree view to view and select the items below or select them from the Feature menu.

2. Under Radio Configuration, double-click on Radio Wide.

   a. In the Transmit Power Levels tab, reduce the radio power level to low: Change TX Power Level Low for Freq. Range A from 16.5 to 10. (Range A 700Mhz UHF and VHF).

      1) Change TX Power Level Low for Freq. Range B from 19.0 to 10. (Range B 800Mhz and UHFR2 (470-520Mhz).

   2) Change TX Power Level High for Freq. Range A from 33.0 to 15.

   3) Change TX Power Level High for Freq. Range B from 38.5 to 15.

  b. In the General tab, set the Out of Range Indicator and Imbalanced Coverage Indicator to Alert & Display.

  c. (Recommended) In the Data tab, enable SNMP Traps. (You can disable it, but the RTU will only detect a loss of context activation the next time it polls the radio (every 10 seconds by default).

  d. (Optional) Specify the Mobile Computer IP address. This is the dummy IP address assigned to the RTU by the radio (by default it is 192.168.128.2). For each radio, it is recommended to change the last digit in the Mobile Computer IP address (e.g. to the Unit ID in Trunking systems.)

  e. (CPS R05.00.00 only) In the Advanced tab, make sure that "MOSCAD Data Enable" is not enabled (not checked.) (For IV&D only. For communication over analog ASTRO Trunking, leave it enabled.) Set Extended DEK to Enable and Ignition Switch to Soft Power Off.

3. Double-click on NAT List -> NAT List Entry 1.

  a. Add an entry to the NAT List:

   1) WAN port = MDLC over IP port number (e.g. 2002)

   2) LAN port = MDLC over IP port number (e.g. 2002)

   3) Static NAT IP Address = Mobile Computer IP Address (e.g. 192.168.128.2).

   4) The Mobile Computer address should match the Mobile Computer IP Address assigned on the Radio Configuration>Radio Wide>Data tab in Step 2 above.

4. Double-click on Trunking ->Trunking System ->Trunking System 1.

  a. In the General tab, set the Type to ASTRO 25. If the proper system key was loaded, the System Key field should already be enabled.

  b. Set the ASTRO 25 Home System ID, Home WACN ID and Unit ID to values obtained from the radio system administrator.

  c. Under Coverage Type, set the type to SmartZone.

  d. In the Astro 25 Channel ID tab, enable the first channel.

  e. In the 700/800 Astro 25 Control Channels tab (700_800 or OBT depending on the band), enter the control channels with which the data subscriber should be able to affiliate. Consult your radio system administrator for the list of control channels.

  f. In the Data tab, enable Packet Data Capable System (PDS), and Terminal Data and disable (uncheck) Rx Voice Interrupts Data.

5. Double-click on Trunking ->Trunking Personality ->Trunking Personality 1.

a. In the General tab, set the Protocol Type to ASTRO 25 and set the System & ID to 1.

b. In the 700/800 Failsoft tab, data only subscribers should set Failsoft Type to disabled. (There is no data service unless the subscriber is affiliated to a wide-area trunking site.)

c. In the Talkgroup tab, set the radio talkgroup value in hexadecimal. Consult your radio system administrator for the talkgroup information.

d. (Recommended) In the Preferred Sites tab, set the status of the first record to None. (This means that data only subscribers are not locked into preferred sites.)

6. Double-click on Zone Channel Assignment ->Zone Channel Assignment.

a. In the Zone tab, set the Zone to the desired zone name (e.g. ZONE1).

b. In the Channels tab, set the Channel to the name which will be displayed on the radio screen (if the radio is Model II or III).

c. Select the Personality type of that channel.

d. Specify the Personality # of that channel.

e. Specify the Talkgroup # of that channel.

7. From the Tools menu, select the Change Control Head command. Make sure the Control Head Type is set to O5(M5) for new models and to W4 for old models, and click OK.

8. From the File Menu, select Save to save changes to the radio.

9. From the File Menu, select Write Device to download the configuration to the radio.

Infrastructure Configuration for the Astro IV&D Digital Radio

In order for the ACE3600 RTU to communicate over the ASTRO IV&D infrastructure (6.4 or later) using the XTL5000/XTL2500 digital radio, the infrastructure must be properly configured using the UCM (User Configuration Manager) tool.

Note: If configuring a border router or any firewall within the CEN (Customer Enterprise network), make sure that the ACE3600's MDLC over IP UDP port number 2002 is enabled for inbound and outbound messages.

Note: In the UCM Radio User Data Settings tab, be sure to set the IP address as Static, to enable Generate ICMP and Source Address Checking, and the Ready timer set to 10 seconds.

RTU Port Configuration for the Astro IV&D Analog Trunked Radio

To enable MDLC communication using Astro XTL5000/XTL2500 radios, use the ACE3600 STS site configuration utility to configure the ACE3600 RTU port (either on-board serial or plug-in port) connected to the radio. For more information, refer to the IP Communications chapter of the ACE3600 STS Advanced Features manual.

Port Type (for Analog Trunked Radio)

Procedure 21-7 How to Configure the ACE3600 Port for the Astro IV&D Analog Radio

1. In the ACE3600 STS click on the desired site, and open the site view.
2. In the Port Tab, click on the plug-in port through which the RTU will communicate with the XTL5000/XTL2500 radio.
3. Set the port parameters as shown in the screen below. The Trunk system parameter should reflect the type of trunking system (e.g. SmartNet, SmartZone.)
   Note: XTL2500 trunking mode supports DPSK modulation only.
4. Save the changes.

PI1	Media	Radio	Link name:		RADIO 1
	Radio System	Trunking	Data speed:	[1200 Bps]:	1200 Bps
	Radio Type	XTL 2500/5000 Trunked Analog	Default routing:	[None]:	None
	Trunk system	SmartNet			
	Modem	DPSK			

Figure 21-7 RTU Site Configuration for MDLC over Analog Trunked System – Port Type Parameters

Port Type (for Analog Conventional Radio)

Procedure 21-8 How to Configure the ACE3600 Port for the Astro IV&D Analog Convetional Radio

1. In the ACE3600 STS click on the desired site, and open the site view.
2. In the Port Tab, click on the plug-in port through which the RTU will communicate with the XTL5000/XTL2500 radio.
3. Set the port parameters as shown in the screen below.
   Note: XTL2500 trunking mode supports DPSK modulation only.
4. Save the changes.

PI1	Media	Radio	Link name:		RADIO 1
	Radio System	Conventional	Zones...		
	Radio Type	General radio	Data speed:	[1200 Bps]:	1200 Bps
	Max no. of repeaters	No repeater	Default routing:	[None]:	None
	Modem	DPSK			

Figure 21-8 RTU Site Configuration for MDLC over Analog Conventional System – Port Type Parameters

Programming the XTL5000/XTL2500 Analog Trunked and Conventional Radio using CPS

The XTL5000/XTL2500 radio is programmed for ACE3600 in the factory and is ready for analog trunked/conventional communication. For user programming of site-specific parameters, the radio should be brought to the Motorola Service Center.

Radio Connections

Follow the Radio Connections instructions described under Programming the Astro IV&D Digital Radio using CPS above.

Radio Disassembly

Follow the Radio Disassembly instructions described under Programming the Astro IV&D Digital Radio using CPS above.

CPS Programming Settings

Before programming the radio, read the codeplug file from the radio and save it to your PC using the File >Read Device command in the CPS (DSP version R06.00.00 for radio firmware R06.01.00.) Open the codeplug file in the CPS and set the parameters as follows.

Procedure 21-9 How to Program the XTL5000/XTL2500 Analog Radio

1. In the CPS, click on the codeplug in the tree view to view and select the items below or select them from the Feature menu.
2. Under Radio Configuration, double-click on Radio Wide.
    a. In the Transmit Power Levels tab, reduce the radio power level to low: Change TX Power Level Low for Freq. Range A from 28.0 to 10.
        1) Change TX Power Level High for Freq. Range A from 53.5 to 15.
    b. In the Advanced tab, make sure that "MOSCAD Data Enable" is enabled. Set Extended DEK to Enable and Ignition Switch to Soft Power Off.
    c. In the Time Out Timer tab, make sure the Time # is set to 3 (for 60 sec).
3. Double-click on Controls.
    a. Click on Control Head.
    b. Make sure the Control Head is O5(M5) for new models and W4 for old models.
    c. Click on Radio VIP.
        1) Set VIP In for VIP 1, VIP 2, and VIP 3 to Blank.
        2) Set VIP Out for VIP 1 to MOSCAD CG.
        3) Set VIP Out for VIP 2 to MOSCAD TXE/CM.
        4) Set VIP Out for VIP 3 to NULL.
4. Double-click on Conventional ->Conventional Personality -> Conventional Personality 1.
    a. In the Rx Options tab, set Unmute/Mute Type to UnMute, Or Mute.
    b. Set Rx Voice/Signal Type to Non-Astro.
    c. Enable (check) Rx Emphasis and Busy LED.
    d. In the Tx Options tab, make sure that the Time Out Timer is set to 3 (for 60 sec).

e. Set Tx Voice/Signal Type to Non-Astro.

f. Set Transmit Power Level to High.

5. Double-click on Trunking ->Trunking System ->Trunking System 1 (for trunked only.)

   a. In the General tab, if the proper system key was loaded, the System Key field should already be enabled.

   b. Set the Type to II.

   c. Set the Type II System ID, and Connect Tone to values obtained from the radio system administrator for the site.

   d. Under Coverage Type, set the type to Disabled.

   e. In the Type II tab, set the Individual ID to the value obtained from the radio system administrator for the site.

   f. Set the Affiliation type to Automatic.

   g. In the Channel Assignment tab, enter the Rx and Tx channel ranges. Consult your radio system administrator for the list of values.

   h. In the OBT Control Channels tab, set the RX Frequency and TX Frequency of each control channel with which the data subscriber should be able to affiliate. Consult your radio system administrator for the list of control channels.

6. Double-click on Trunking ->Trunking Personality ->Trunking Personality 1 (for trunked only.)

   a. In the General tab, set the Protocol Type to II and set the System ID to the value obtained from the radio system administrator for the site. Make sure that the Time Out Timer is set to 3 (for 60 sec). Check that the Type II Individual ID is set to the value obtained from the radio system administrator for the site.

   b. In the Talkgroup tab, set the radio talkgroup value in hexadecimal. Consult your radio system administrator for the talkgroup information. (Note: Talkgroup for voice in analog trunking is the same for voice and data on analog trunk.

7. From the File Menu, select Save to save changes to the radio.

8. From the File Menu, select Write Device to download the configuration to the radio.

XTL5000/XTL2500 Radio Models and Options for ACE3600

The XTL5000/XTL2500 radio installation kit is used with one of the following XTL5000/ XTL2500 radios:

Description	Nomenclature	Band
XTL5000 Mobile 10-35 W, 764-870MH	M20URS9PW1 N	764 - 870 MHz
XTL5000 UHF R1 Mobile 10-40 W 380-470	M20QSS9PW1 N	380 - 470Mhz

Description	Nomenclature	Band
XTL5000 UHF R2 450-520 MHZ 10-45 W	M20SSS9PW1 N	450 - 520Mhz
XTL5000 VHF Mobile 10-50 W 136-174 MHZ	M20KSS9PW1 N	136 - 174Mhz
XTL2500 Mobile 10-35 W, 764-870MHz	M21URM9PW1N	764-870 MHz
XTL2500 Mobile 10-40 W, 380-470MHz	M21QSM9PW1 N	380-470MHz
XTL2500 Mobile 10-45 W, 450-520MHz	M21SSM9PW1 N	450-520 MHz
XTL2500 Mobile 10-50 W, 136-174MHz	M21KSM9PW1 N	136-174 MHz

All of the following options may be ordered with the XTL2500 radio:

Option Name	Option Number
ADD: O5 CONTROL HEAD	G442
ADD: NO MICROPHONE NEEDED	G90
ENH: SOFTWARE ASTRO DIGITAL CAI OPERATION	G806
ENH: ASTRO PROJECT 25 TRUNKING SOFTWARE	G361
ADD: CONTROL HEAD SOFTWARE, O5	G444
ENH: SMARTZONE OPERATION	G51
ENH: RS232 PACKET DATA INTERFACE	W947
ADD: DASH MOUNT	G66
ADD: NO SPEAKER	G142
ADD: NO ANTENNA	G89

XTS2500 Radio Installation Kit

The XTS2500 radio installation kit (ACE3600 option V156AG or kit FLN3814A) enables the user to install the XTS2500 radio in ACE3600 Remote Terminal Units (RTU). The RTU can use the XTS2500 in digital mode to communicate over the ASTRO 6.x/7.x system. The following hardware and firmware are required:

- Radio firmware version 6.4 and above for trunked IV&D
- ASTRO Infrastructure version SR6.5 and above for trunked IV&D
- ACE3600 firmware 10.00 and above
- ACE3600 System Tools Suite (STS) version 10.50 and above

The installation kit includes brackets, cables, screws and installation instructions.

After the XTS2500 radio is installed in the RTU, the RTU port is configured, the IP address information is downloaded, the radio is context activated and finally, communication from the RTU over the air is verified. For more information on MDLC over ASTRO IV&D (Integrated Voice & Data), refer to the MDLC over IP chapter of the ACE3600 STS Advanced Features Manual.

Installation

CAUTION

Before installing the XTS2500 radio on the RTU, configure the power supply AUX2A/B connector to 7.5V DC in the ACE3600 STS site configuration (using the Power Supply <n> Auxiliary 2 voltage parameter.) Download the updated site configuration to the RTU. Failure to do so might damage the radio.

The installation kit includes a radio bracket, metal bracket with built-in screws, power cables, communication cable, antenna cable and plastic strips. The XTS2500 can be mounted on the ACE3600 RTU using the kit as follows:

Procedure 21-10 How to Install the XTS2500 Radio on the Metal Chassis

1. Attach the XTS 2500 radio to the radio bracket (from FHN6674A). (See Figure 21-9.)

2. Connect the programming cable (RKN4106A) provided with the radio to the Accessory connector on the radio. (See Figure 21-11.) Connect the other end of the programming cable to the 9-pin D-type (Radio) connector on the communication cable (FKN8516A) and tighten the screws attached to the programming cable. Do not use the 25-pin connector; it is for programming only.

3. Connect the other end of the communication cable (RJ45 connector) to the plug-in port of the ACE3600 CPU.

4. Connect the 7.5V DC power cable (FKN8515A) to the AUX2A or AUX2B auxiliary power output connector on the RTU power supply. Connect the other end of the power cable to the DC adapter on the radio bracket (FHN6674A). (See Figure 21-10 and Figure 21-11.)

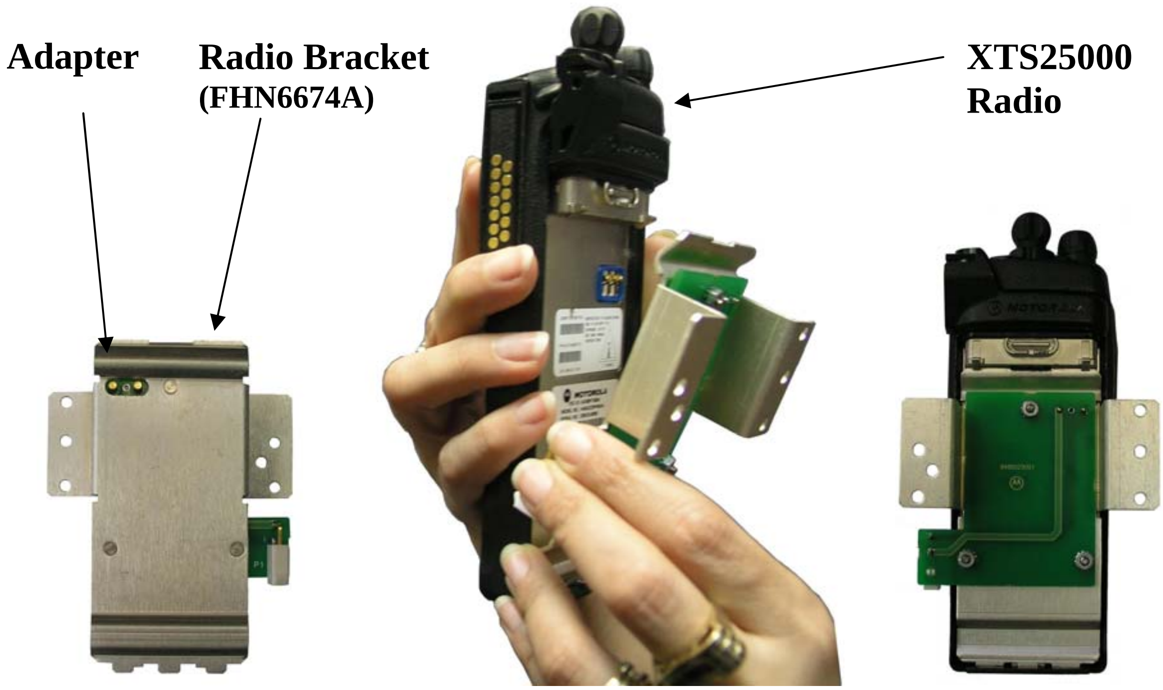


Figure 21-9 XTS2500 Radio and Metal Bracket

5. Add the BNC adapter (#5871143Y04) to the XTS2500 radio antenna connector. (See Figure 21-10.)

6. Attach the BNC connector of the antenna cable (FKN8434A) to the radio's BNC adapter. Route the antenna cable through the small wire clamps along the left side edge of the RTU chassis, according to the placement of the radio on the chassis. Attach the N-type connector at the other end to the opening on the bottom of the RTU housing using the supplied locking washer and nut. (See Figure 21-10.)

7. Mount the radio/bracket unit on the metal bracket (#0789422V40 from FHN6674A) using the four supplied screws.

8. Mount the metal bracket on the RTU chassis above the I/O modules, using the three built-in screws, with the bottom of the radio towards the chassis. (See Figure 21-10.)

9. Attach all cables to the chassis using the supplied wire clamps.

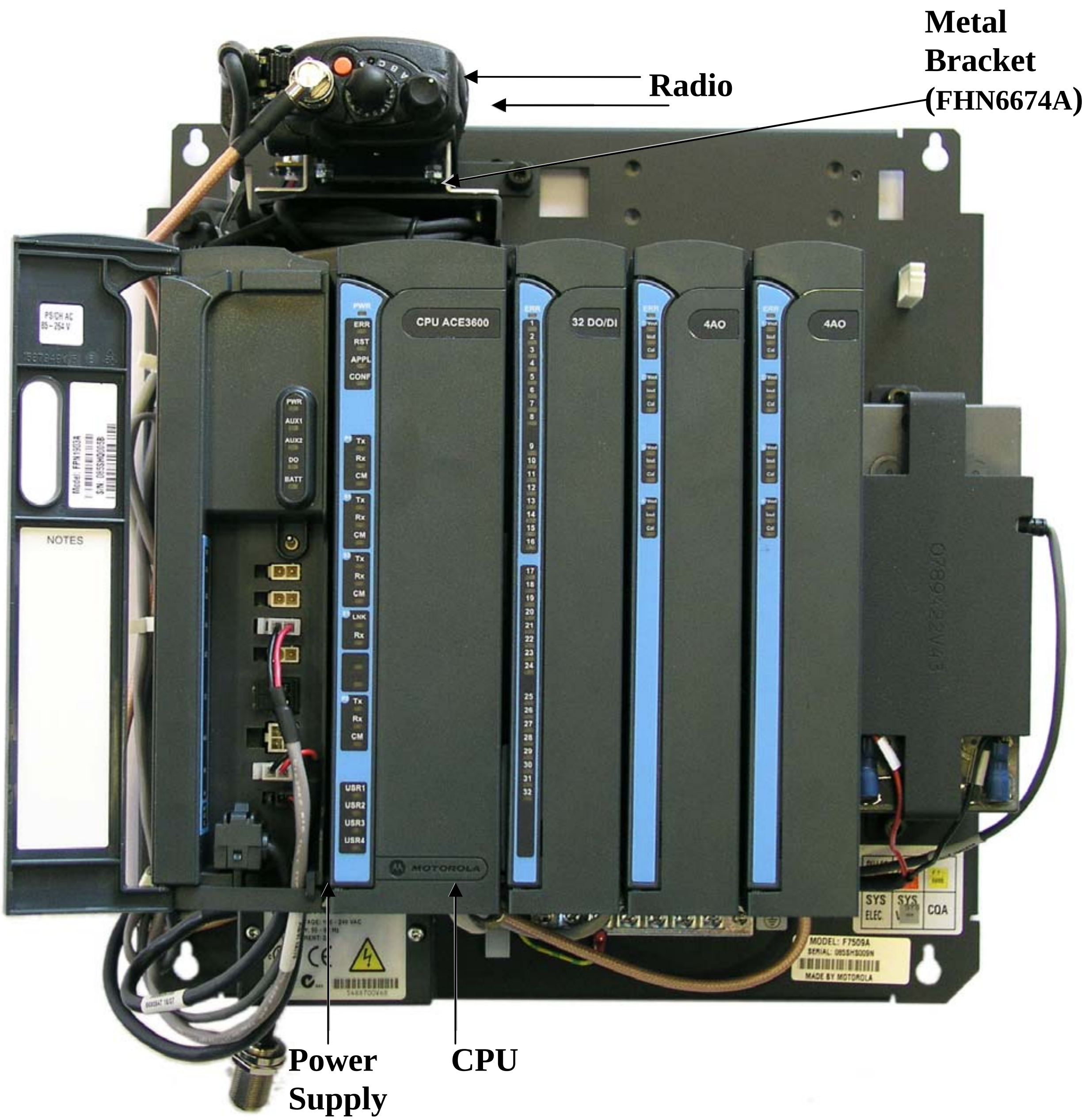


Figure 21-10 XTS2500 Radio Installed on ACE3600 Chassis

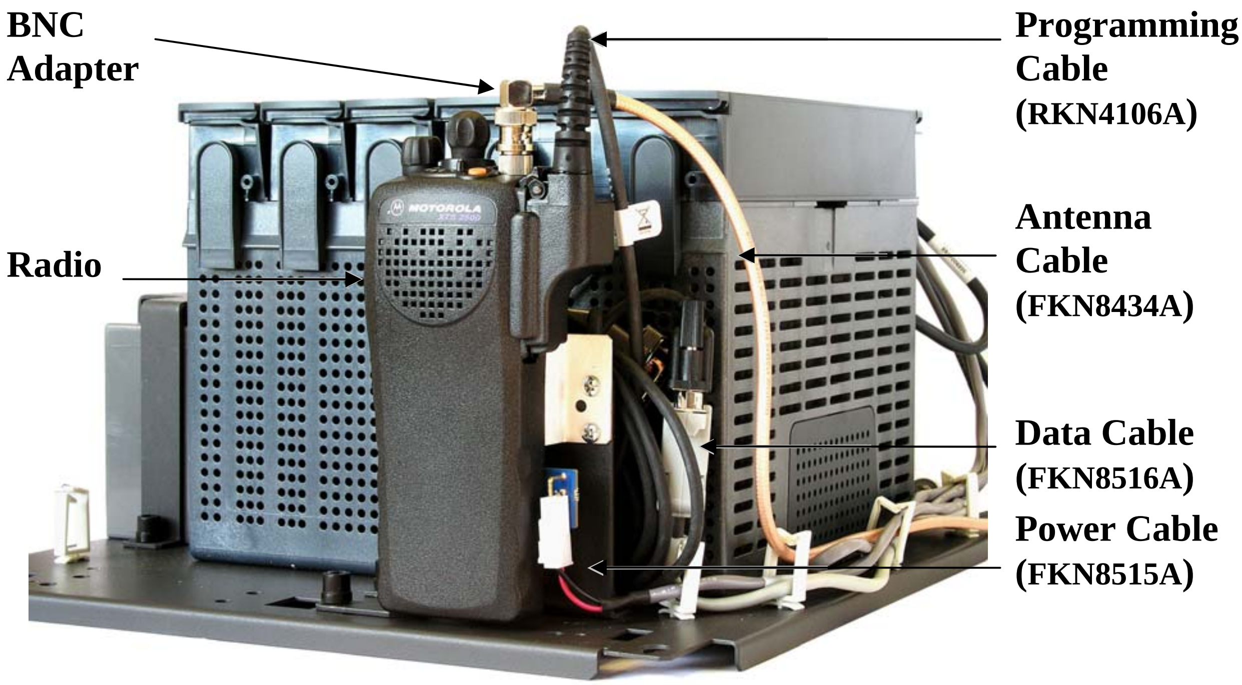


Figure 21-11 XTS2500 Radio Installed on ACE3600 Chassis - Cable Connections

RTU Port Configuration

To enable MDLC communication over ASTRO IV&D, use the ACE3600 STS (≥V10.50) to configure the RTU port connected to the XTS25000 radio. For more information, refer to the MDLC over IP chapter of the ACE3600 STS Advanced Features manual.

The following figures show the port configuration and advanced parameter configuration. Although these show Port SI1, the same values can be applied to other ports, where relevant.

Port Type

Procedure 21-11 How to Configure the ACE3600 Port for the Astro XTS2500 Digital Radio

1. In the ACE3600 STS click on the desired site, and open the site view.
2. In the Port Tab, click on the on-board or plug-in port through which the RTU will communicate with the XTS2500 radio.
3. Confirm that the port parameters and data speed are as shown in the screen below.
4. Define desired links.
5. If you plan to synchronize the RTU time from the Front End Processor (FEP) in the Customer Enterprise Network (CEN), specify the IP address of the FEP in the NTP field. This IP address information is provided by your ASTRO IV&D system operator.
6. Save the changes.

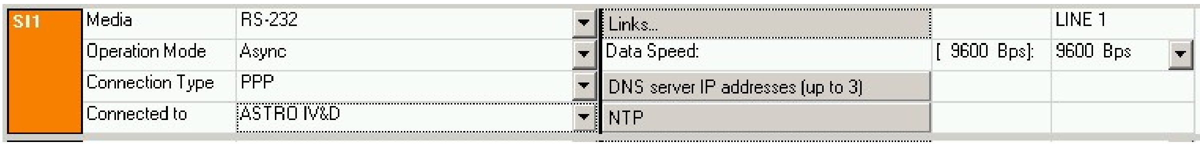


Figure 21-12 RTU Site Configuration for MDLC over ASTRO IV&D – Port Type Parameters

Advanced Parameter Configuration

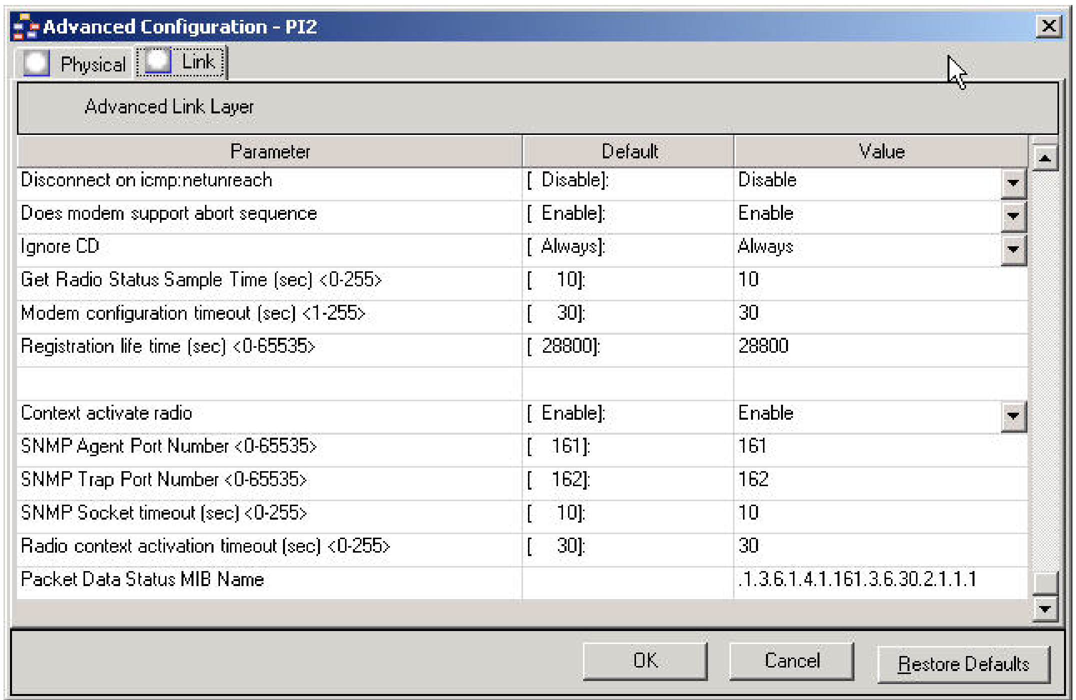


Figure 21-13 RTU Site Configuration for MDLC over ASTRO IV&D – Advanced Parameters

Generally no other changes are required to Advanced Physical or Link Layer parameters. For information on these parameters, see the MDLC over IP chapter of the ACE3600 STS Advanced Features manual.

Procedure 21-12 How to Configure the Advanced Parameters of the ACE3600 Port for the Astro XTS2500 IV&D Digital Radio

1. (ASTRO System 6.3-6.5 only) Make sure that the Advanced Link parameter Registration life time to 28800 seconds (default) in order to restart the radio periodically.

2. If any changes are required, click on the appropriate screen in the Port Tab.

3. Change the settings as necessary.
   Note: The Default Group ID Address should be left 000.000.000. The actual values will be read by the RTU from the radio upon connection.

4. Save any changes.

5. Save the project.

6. Download the site configuration to the ACE3600 RTU.

IP Conversion Table (for Astro XTS2500 IV&D Digital Radio)

Prepare an IP conversion table if the RTU must communicate with another RTU or an IP Gateway. In the IP conversion table, specify the IP address of each RTU port (site ID + link ID). This IP address is assigned by the infrastructure operator.

Note that an IP address is obtained from the radio once it is connected to the RTU port over PPP. The IP address obtained from the radio is not the real IP address set by the infrastructure, but rather a dummy address. This dummy is configured in the radio via the CPS Mobile Computer IP address parameter (by default 192.168.128.2).

When device LINxL level 0 is retrieved using the ACE3600 STS Software Diagnostics tool, the IP Address displayed is this dummy address and not the actual IP address assigned by the infrastructure operator.

It is recommended to create two IP conversion tables:

1. The first is downloaded to the FIU or IP Gateway on the LAN and includes the site and IP information for each RTU.

2. The second is downloaded to all RTUs which are connected to the infrastructure with ASTRO IV&D radios, and includes the site and IP information for the FIU and IP Gateway.

For detailed instructions on preparing the IP conversion table, refer to the IP Communications chapter of the ACE3600 STS Advanced Features manual.

Programming the Astro XTS2500 IV&D Digital Radio using CPS

The XTS2500 radio is programmed for ACE3600 in the factory and is ready for ASTRO IV&D communication. For user programming of site-specific parameters, the radio should be brought to the Motorola Service Center.

Radio Connections

To program the XTS2500 radio with Customer Programming Software (CPS), the radio must be connected to a PC.

Procedure 21-13 How to Connect the XTS2500 Radio to the CPS

1. Power on the radio.

2. Disconnect the programming cable (RKN4106A) from the 9-pin D-type (Radio) connector on the data cable (FKN8516A).

3. Connect the D-type connector of the programming cable (RKN4106A) to the serial port of a PC on which the ASTRO CPS software is installed.

4. Program the radio using the CPS, as described in CPS Programming Settings below.

5. After radio programming, reconnect the communication and programming cables as described in the Installation section above.

Radio Disassembly

If the XTS2500 radio is to be programmed outside of the ACE3600 housing, disassemble the radio as follows:

Procedure 21-14 How to Disassemble the XTS2500 Radio from the ACE3600 Metal Chassis

1. Disconnect the antenna cable (FKN8434A) from the Antenna connector on the radio.
2. Remove the radio/bracket unit from the RTU chassis by unscrewing the three built-in screws.
3. Disconnect the DC power cable (FKN8515A) from the Power connector on the radio.
4. Disconnect the 13-pin connector of the programming cable (RKN4106A) from the Accessory connector on the radio.
5. Detach the metal bracket (#0789422V40 from FHN6674A) by unscrewing the four radio screws (#0310906A67), two on each side. (See Figure 21-10.)
6. Take the radio to a laboratory for programming, as described in CPS Programming Settings below.

CPS Programming Settings

Before programming the radio, read the codeplug file from the radio and save it to your PC using the File->Read command in the CPS (R05.00.00 or above). Open the codeplug file in the CPS and set the parameters as follows.

Procedure 21-15 How to Program the XTS2500 Digital Radio

1. In the CPS, click on the codeplug in the tree view to open the items below.
2. Under Radio Configuration, double-click on Radio Wide.
   a. In the General tab, set the Out of Range Indicator and Imbalanced Coverage Indicator to Alert & Display.
   b. (Recommended) In the Data tab, enable SNMP Traps. (You can disable it, but the RTU will only detect a loss of context activation the next time it polls the radio (every 10 seconds by default).
   c. (Optional) Specify the Mobile Computer IP address. This is the dummy IP address assigned to the RTU by the radio (by default it is 192.168.128.2). For each radio, it is recommended to change the last digit in the Mobile Computer IP address (e.g. to the Unit ID in Trunking systems.)
3. Double-click on NAT List -> NAT List Entry 1.
   a. Add an entry to the NAT List:

      1) WAN port = MDLC over IP port number (e.g. 2002)

      2) LAN port = MDLC over IP port number (e.g. 2002)

      3) Static NAT IP Address = Mobile Computer IP Address (e.g. 192.168.128.2).

The Mobile Computer address should match the Mobile Computer IP Address assigned on the Radio Configuration>Radio Wide>Data tab in Step 2 above.

4. Double-click on Trunking ->Trunking System ->Trunking System 1.

    a. In the General tab, set the Type to ASTRO 25. If the proper system key was loaded, the System Key field should already be enabled.

    b. Set the ASTRO 25 Home System ID, Home WACN ID and Unit ID to values obtained from the radio system administrator.

    c. Under Coverage Type, set the type to SmartZone.

    d. In the Astro 25 Channel ID tab, enable the first channel.

    e. In the 700/800 Astro 25 Control Channels tab (700_800 or OBT depending on the band), enter the control channels with which the data subscriber should be able to affiliate. Consult your radio system administrator for the list of control channels.

    f. In the Data tab, enable Packet Data Capable System (PDS), and Terminal Data and disable (uncheck) Rx Voice Interrupts Data.

5. Double-click on Trunking ->Trunking Personality ->Trunking Personality 1.

    a. In the General tab, set the Protocol Type to ASTRO 25 and set the System & ID to 1.

    b. In the 700/800 Failsoft tab, data only subscribers should set Failsoft Type to disabled. (There is no data service unless the subscriber is affiliated to a wide-area trunking site.)

    c. In the Talkgroup tab, set the radio talkgroup value in hexadecimal. Consult your radio system administrator for the talkgroup information.

    d. (Recommended) In the Preferred Sites tab, set the status of the first record to None. (This means that data only subscribers are not locked into preferred sites.)

6. Double-click on Zone Channel Assignment ->Zone Channel Assignment.

    a. In the Zone tab, set the Zone to the desired zone name (e.g. ZONE1).

    b. In the Channels tab, set the Channel to the name which will be displayed on the radio screen (if the radio is Model II or III).

    c. Select the Personality type of that channel.

    d. Specify the Personality # of that channel.

    e. Specify the Talkgroup # of that channel.

7. From the File Menu, select Save to save changes to the radio.

8. From the File Menu, select Write Device to download the configuration to the radio.

Infrastructure Configuration for the Astro IV&D XTS2500 Digital Radio

In order for the ACE3600 RTU to communicate over the ASTRO IV&D infrastructure (6.4 or later) using the XTS2500 digital radio, the infrastructure must be properly configured using the UCM (User Configuration Manager) tool.

Note: If configuring a border router or any firewall within the CEN (Customer Enterprise network), make sure that the ACE3600's MDLC over IP UDP port number 2002 is enabled for inbound and outbound messages.

Note: In the UCM Radio User Data Settings tab, be sure to set the IP address as Static, to enable Generate ICMP and Source Address Checking, and the Ready timer set to 10 seconds.

XTS2500 Radio Models and Options for ACE3600

The XTS2500 radio installation kit is used with one of the following XTS2500 radio:

Description	Nomenclature	Band
XTS2500 PORTABLE 1-3 WATTS, 764-870MH	H46UCC9PW5 N	764-870 MHz
XTS2500 VHF PORTABLE 1-5 WATTS 136-174	H46KDC9PW5 N	136-174 MHz
XTS2500 UHF R1 PORTABLE 1-5 WATTS 380-470	H46QDC9PW5 N	380-470 MHz
XTS2500 UHF R1 PORTABLE 1-5 WATTS 450-520	H46SDC9PW5 N	450-520 MHz

All of the following options may be ordered with the XTS2500 radio:

Option Name	Option Number
ENH: SOFTWARE TRUNKING 9600 BAUD Includes: 9600 Baud, Wide Area SmartZone, OmniLink, ASTRO Digital CAI, & PTT-ID Display	Q574
ENH: RADIO PACKET DATA	Q947
DEL: ANTENNA	H112
DEL: BATTERY ALL TOGETHER	H207
DEL: BELT CLIP	H301
ADD: DATA CABLE	Q157

CDM750 Radio Installation Kit

The CDM750 radio installation kit (ACE3600 option V143AH/kit FLN3638A) enables the user to install the CDM750 radio series in ACE3600 Remote Terminal Units (RTU). The FLN3638A installation kit includes a bracket, adapter, and cables.

Installation

The CDM750 radio can be mounted on the ACE3600 RTU as follows:

Procedure 21-16 How to Install the CDM750 Radio on the Metal Chassis

1. Attach the radio plug-in port from the installation kit (FLN3696A) to the desired opening on the ACE3600 CPU module. For instructions on attaching plug-in ports, see Connecting Plug-In Ports to the CPU Module in the CPU Module chapter above.
2. Connect the radio adapter (FLN3639A) 16-pin connector to the radio Accessory connector (See Figure 21-14.)
3. Connect the power cable (FKN8436A) to the radio power connector, and the opposite end of the cable to the AUX1A or AUX1B connector on the ACE3600 power supply module. Connect the free red wire to the ignition pin on the radio adapter.
4. Connect the communication cable (FKN8427A) to the rear connector (8-pin RJ45 connector) of FLN3639A. Place one Fair-Rite soft ferrite (#7683477X01 from the supplied ferrite kit FHN7007A) on the cable near the bottom of the CPU door, loop the cable one turn around it, and clamp the ferrite on the cable.
   Connect the other end of the communication cable to the plug-in port of the ACE3600 CPU module.

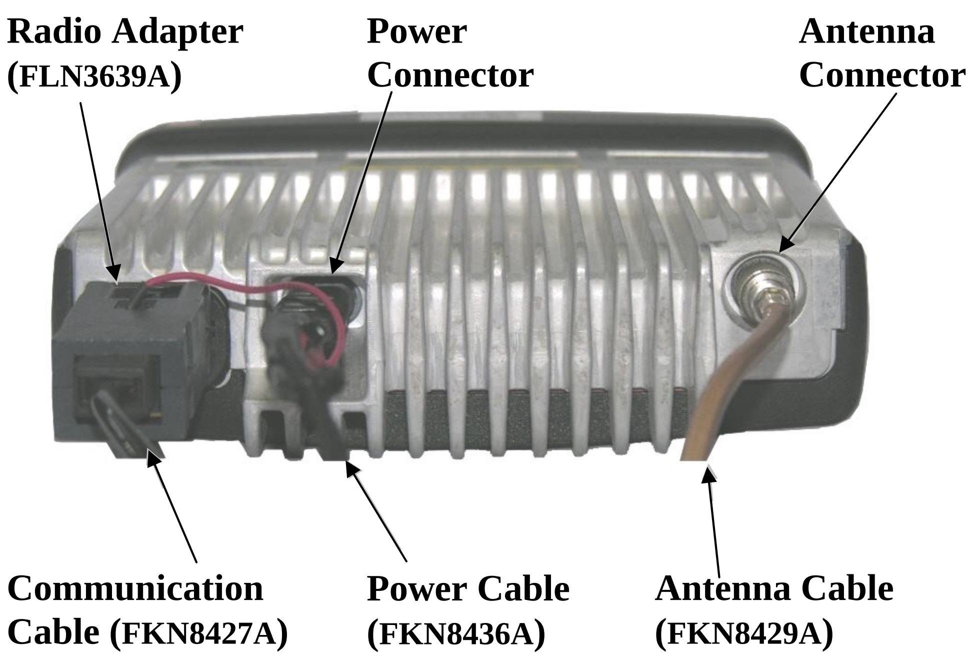


Figure 21-14 CDM750 Antenna, Power and Communication Cable Connections

4. Connect the antenna cable (FKN8429A) to the Antenna connector on the radio and to the opening on the bottom of the ACE3600 RTU housing, using the four supplied screws. See Figure 21-14 and Figure 21-16.)

5. Attach the radio to the bracket (0789422V45 from FHN6898A) by using screws and washers from kit FHN6898A. See Figure 21-15 below.

Figure 21-15 CDM750 Radio and Metal Bracket

6. Attach the complex (radio + bracket) using the four supplied screws to the ACE3600 chassis. See Figure 21-16 below.

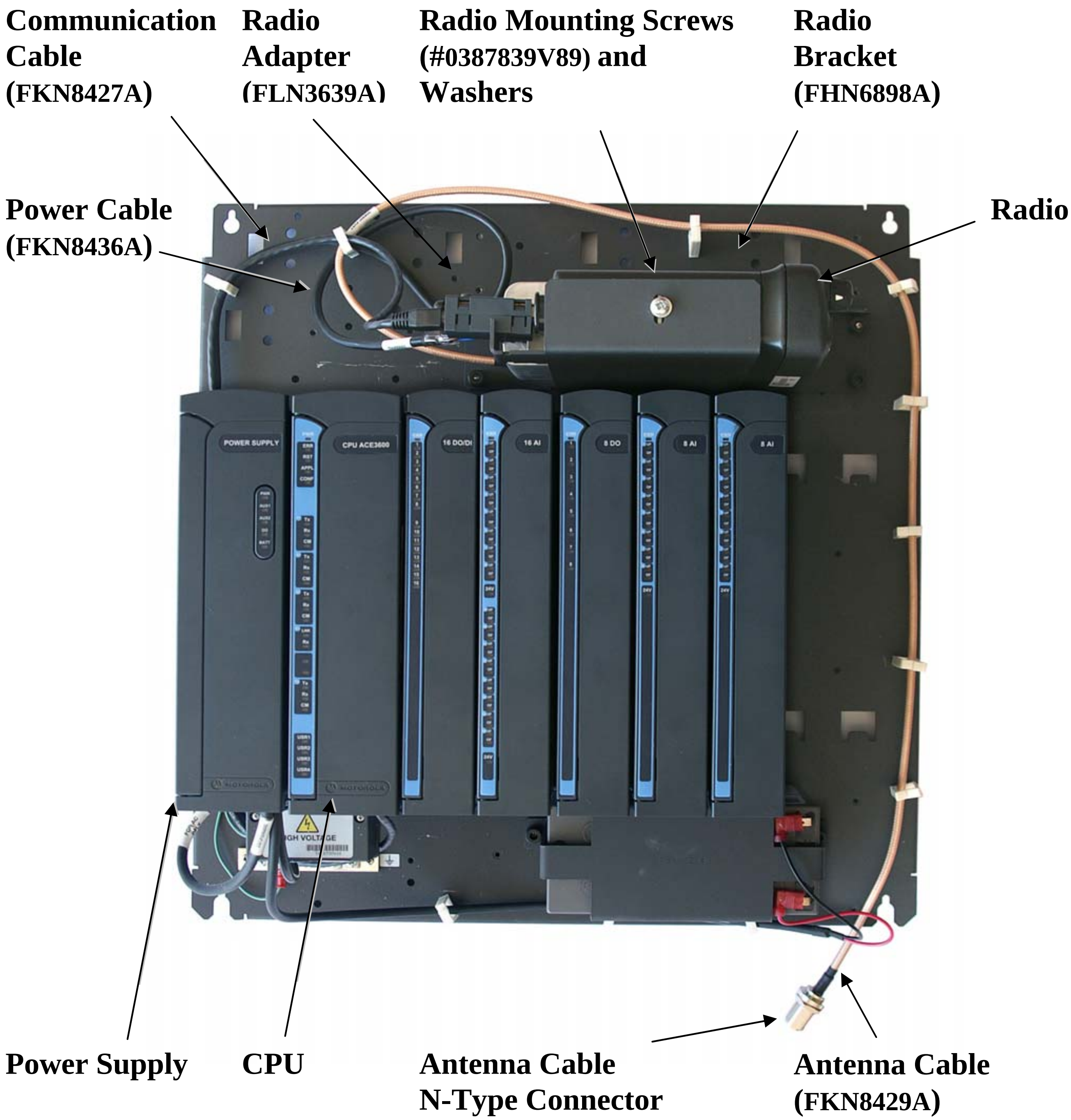


Figure 21-16 CDM750 Radio Installed on ACE3600 Chassis

RTU Port Configuration for the CDM750 Radio

To enable MDLC communication using CDM750 radios, use the ACE3600 STS site configuration utility to configure the ACE3600 RTU plug-in port connected to the radio.

The following figures show the port configuration and advanced parameter configuration. Although these show Port PI1, the same values can be applied to port PI2 as well, where relevant.

Port Type

Procedure 21-17 How to Configure the ACE3600 Port for the CDM750 Radio

1. In the ACE3600 STS, click on the desired site, and open the site view.
2. In the Port Tab, click on the plug-in port through which the RTU will communicate with the radio.
3. Confirm that the port parameters and data speed are as shown in the screen below.
4. Define desired radio links and zones if necessary.
5. Save the changes. Generally no other changes are required to Advanced Physical or Link Layer parameters.

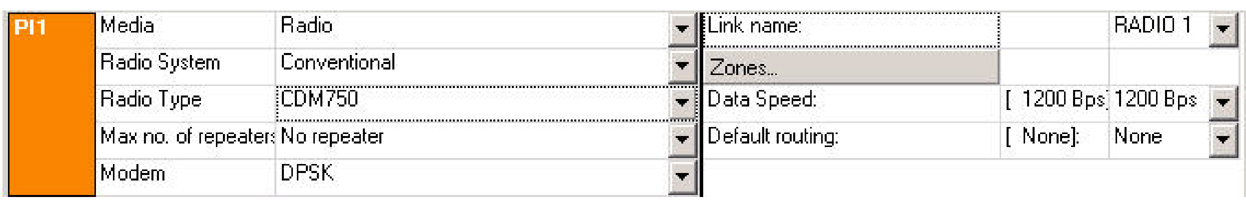


Figure 21-17 RTU Site Configuration for MDLC over CDM750 Radio – Port Type Parameters

Programming the CDM750 Radio using CPS

The CDM750 radio is programmed for ACE3600 in the factory and is ready for communication. For user programming of site-specific parameters, follow the instructions below.

Radio Connections

To program the CDM750 radio with Customer Programming Software (CPS), the radio is connected to a PC using the standard Radio Interface Box (RIB).

Procedure 21-18 How to Connect the CDM750 Radio to the CPS

1. Connect one end of the programming cable (PMKN4004) to the radio Accessory connector and the other end to the 25-pin connector on the RIB (RLN4008). The RIB and cable are not supplied and must be ordered separately.
2. Using the 9-pin interface cable (3080369B72), connect the RIB to the serial port of a PC on which the CDM750 CPS software (HVN9025) is installed.
3. Connect the RIB to a power RIB power supply or 9V battery.

Radio Disassembly

If the CDM750 radio is to be programmed outside of the ACE3600 housing, disassemble the radio as follows:

Procedure 21-19 How to Disassemble the CDM750 Radio from the ACE3600 Metal Chassis

1. Disconnect the antenna cable (FKN8429A) from the radio Antenna connector.
2. Remove the radio/bracket unit from the RTU chassis by unscrewing the four built-in screws.
3. Disconnect the DC power cable (FKN8436A) from the radio Power connector.
4. Disconnect the radio adapter (FLN3639A) 16-pin connector from the radio Accessory connector.
5. Detach the metal bracket (FHN6898A) by unscrewing the two radio screws (#0387839V89), one on each side. (See Figure 21-15.)

CPS Programming Settings

The following programming instructions must be performed before connecting a CDM750 radio to the ACE3600 family Remote Terminal Units (RTU). These instructions define miscellaneous settings and the function of each pin in the radio's general purpose I/O connector.

Procedure 21-20 How to Program the CDM750 Radio

1. Before programming the radio, read the codeplug file from the radio and save it to your PC using the File >Read Device command in the CPS.
2. Open the codeplug file in the CPS. Click on the codeplug in the tree view to view and select the items below or select them from the Feature menu.
3. Under Radio Configuration, change the settings on the Basic, Tx Power, Accessory Configuration, and Accessory Pins tabs, as shown in the screens below.
4. Under Controls and Menus->Conventional Buttons, change the settings to the Mobile Key Buttons and Programmable Buttons tabs, as shown in the screens below.
5. Under Conventional Personality 1, change the settings to the Basic, Options and Advanced tabs, as shown in the screens below.
6. Under Personality Assignment to Zone 1, make sure that the desired channel(s) appear on the list on the Channels tab. If not all the assigned channels are required, remove them from the assignment list.
7. From the File Menu, select Save to save changes to the radio.
8. From the File Menu, select Write Device to download the configuration to the radio.

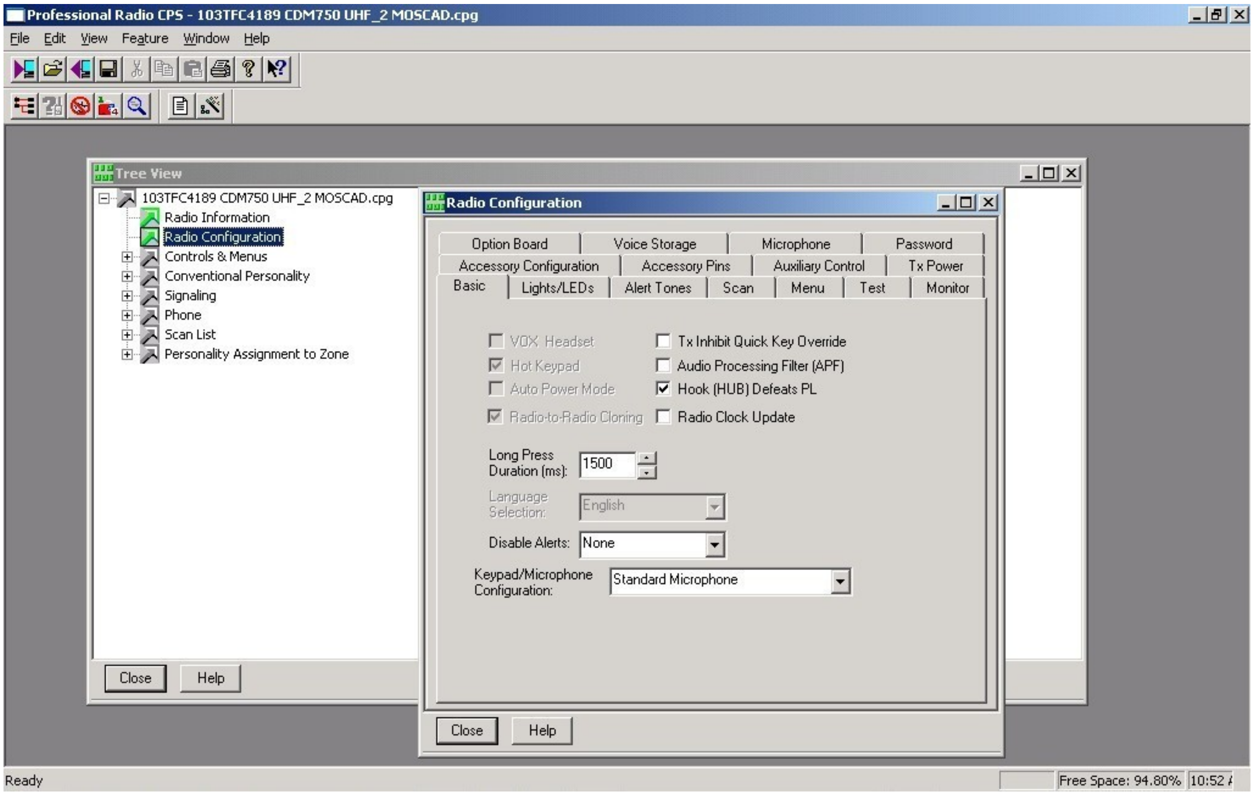


Figure 21-18 Radio Configuration- Basic Settings

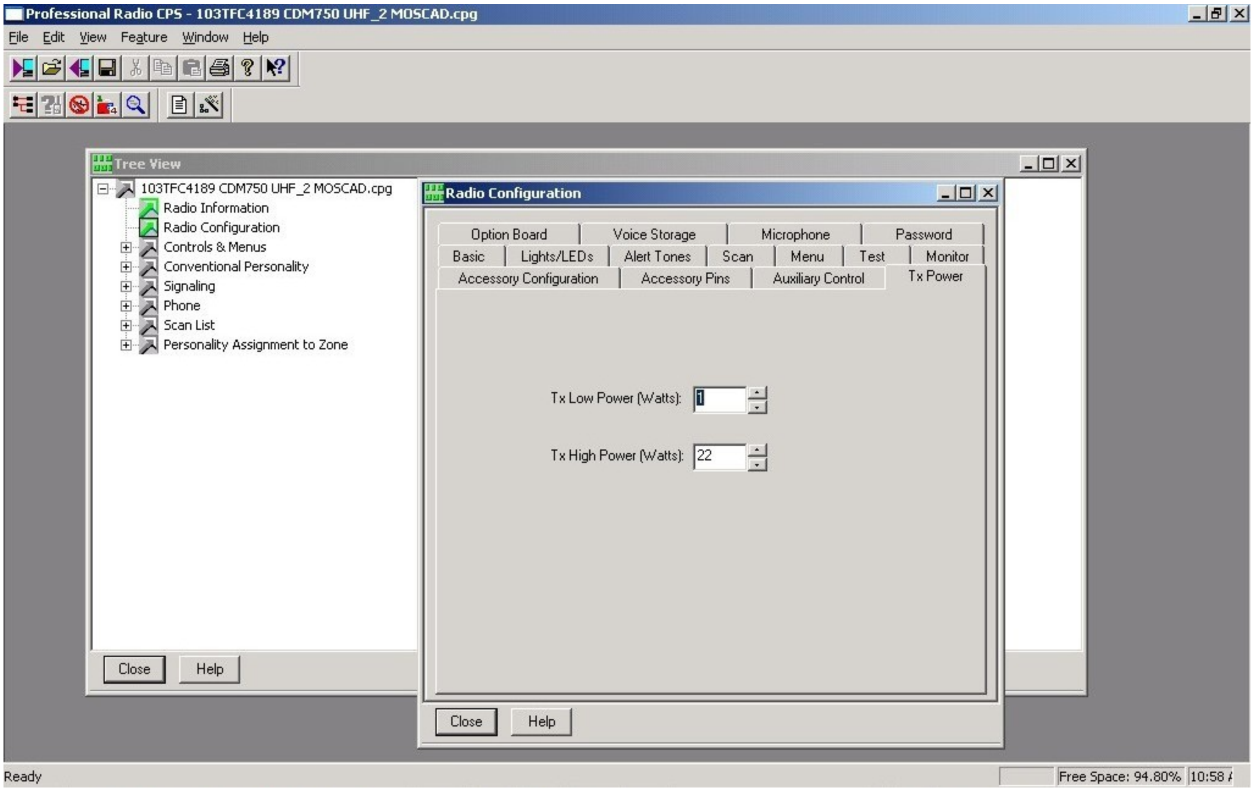


Figure 21-19 Radio Configuration- Tx Power

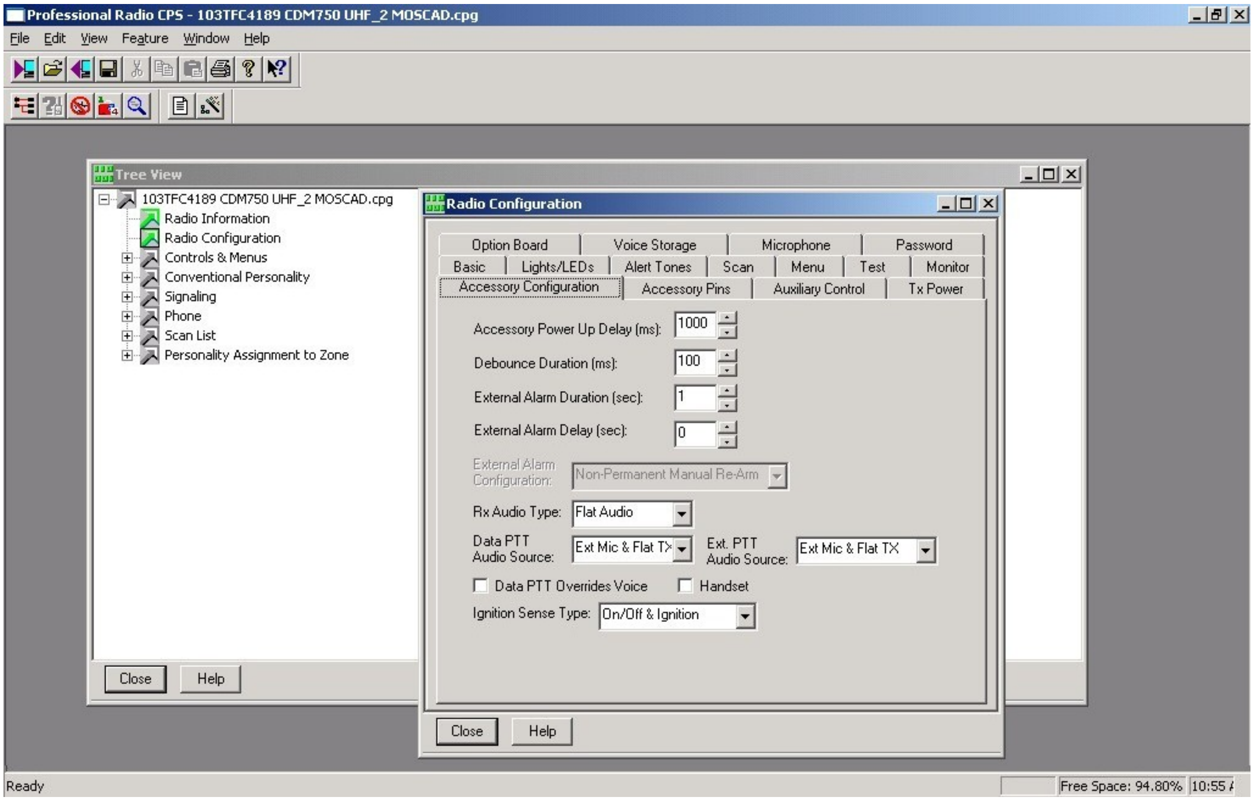


Figure 21-20 Radio Configuration - Accessory Connector Configuration

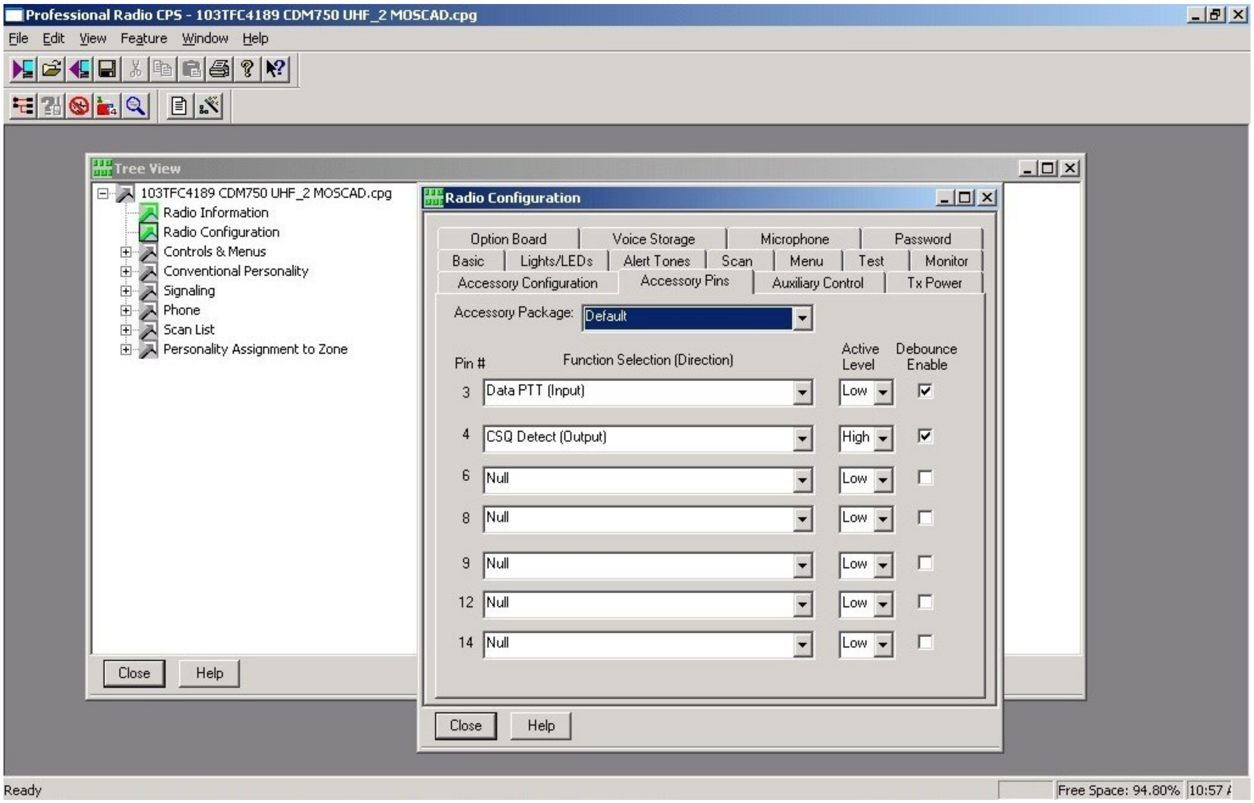


Figure 21-21 Radio Configuration - Accessory Pins Definition

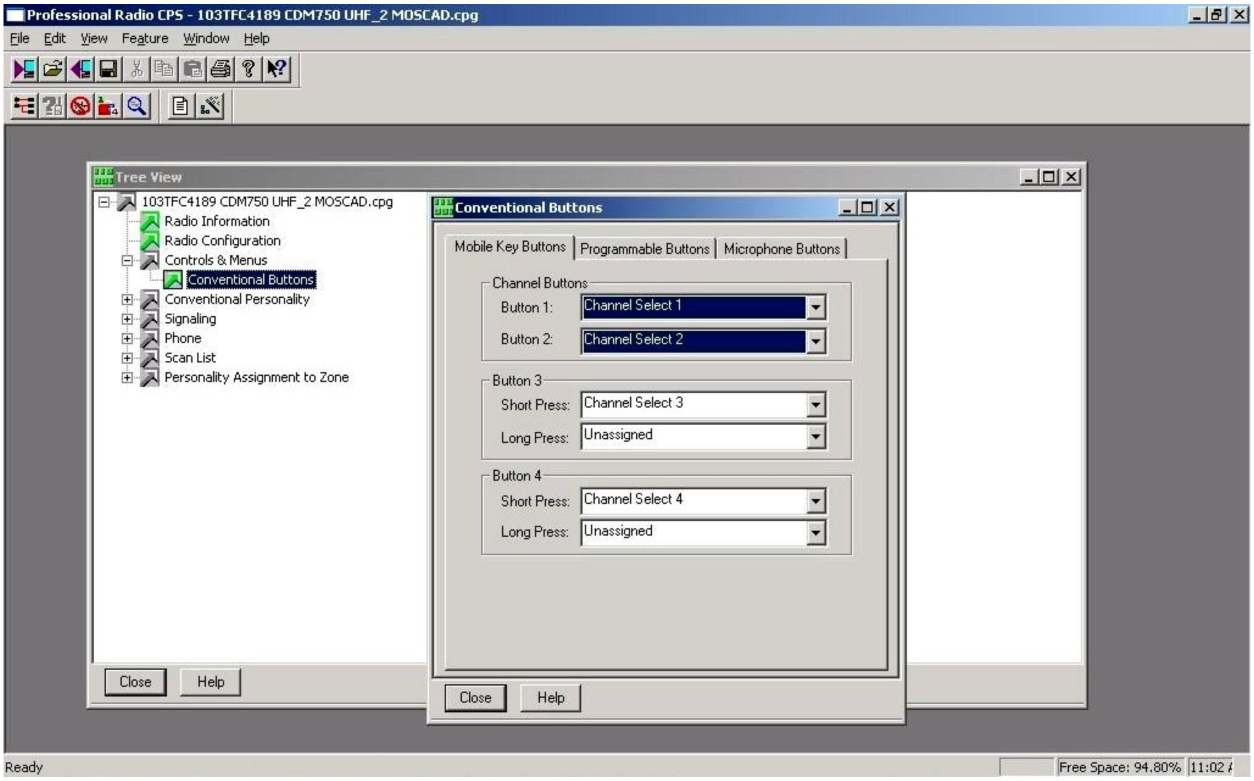


Figure 21-22 Conventional Buttons Configuration – Mobile Key Buttons

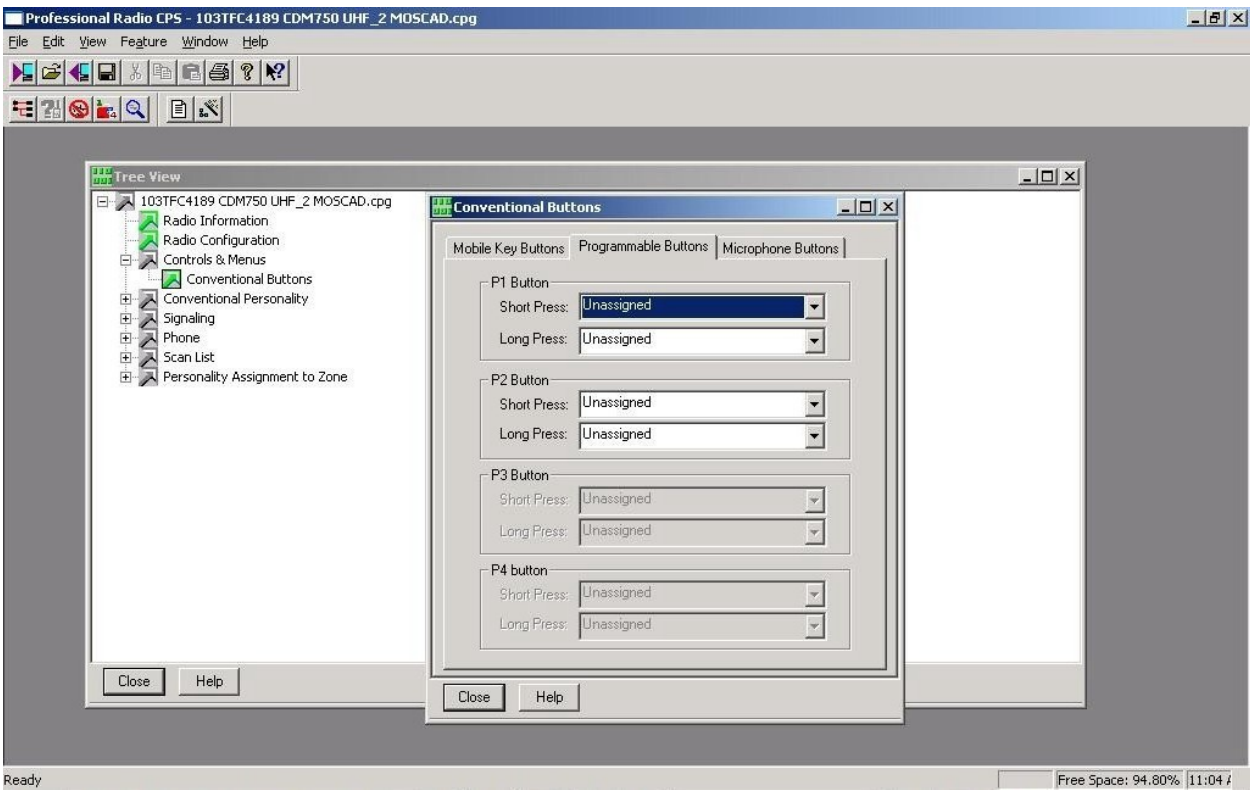


Figure 21-23 Conventional Buttons Configuration – Programmable Buttons

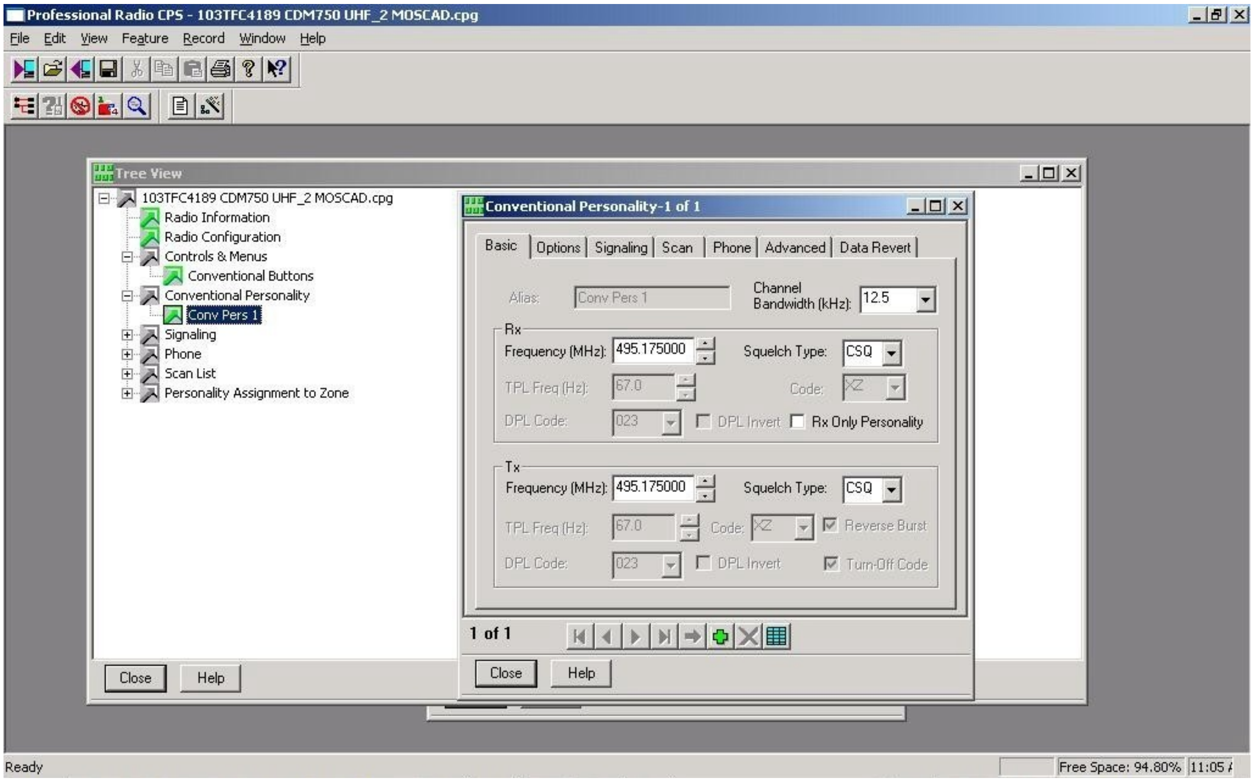


Figure 21-24 Conventional Personality Configuration – Basic Settings

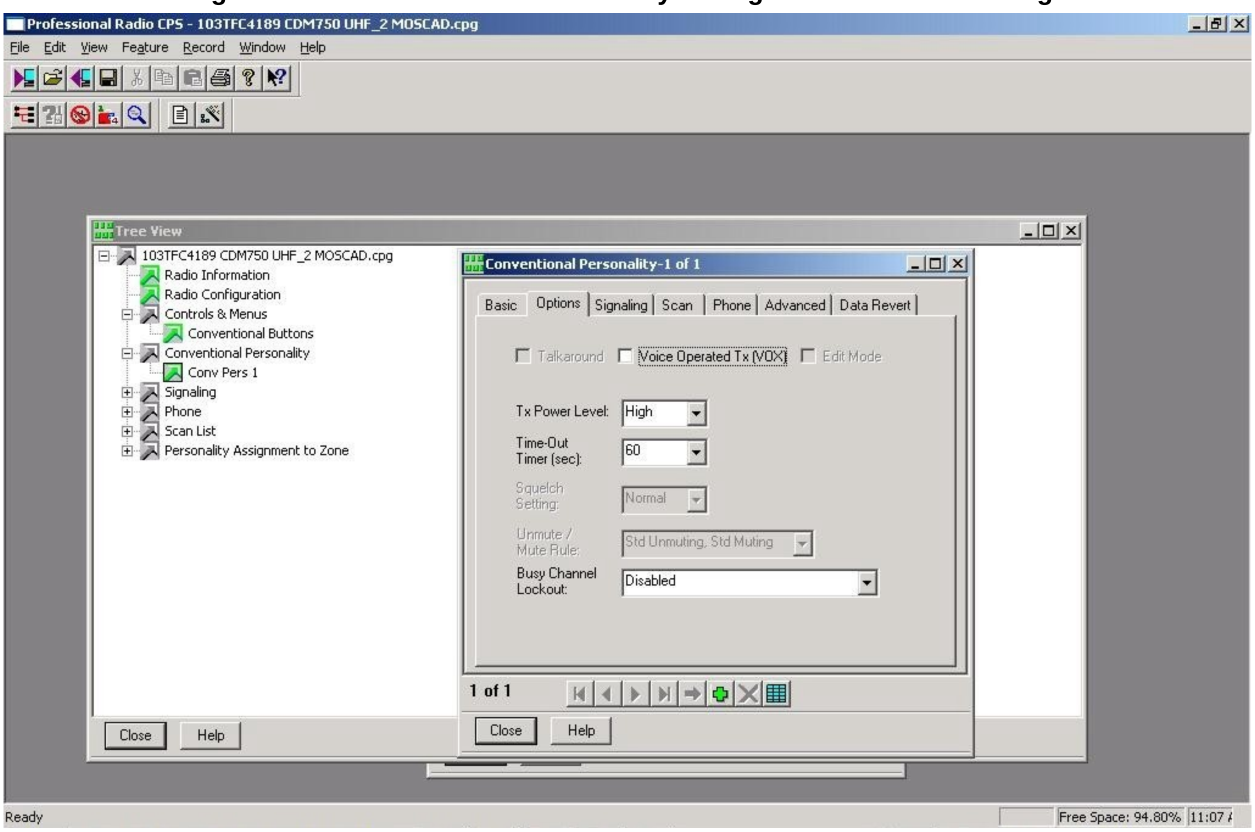


Figure 21-25 Conventional Personality Configuration – Options

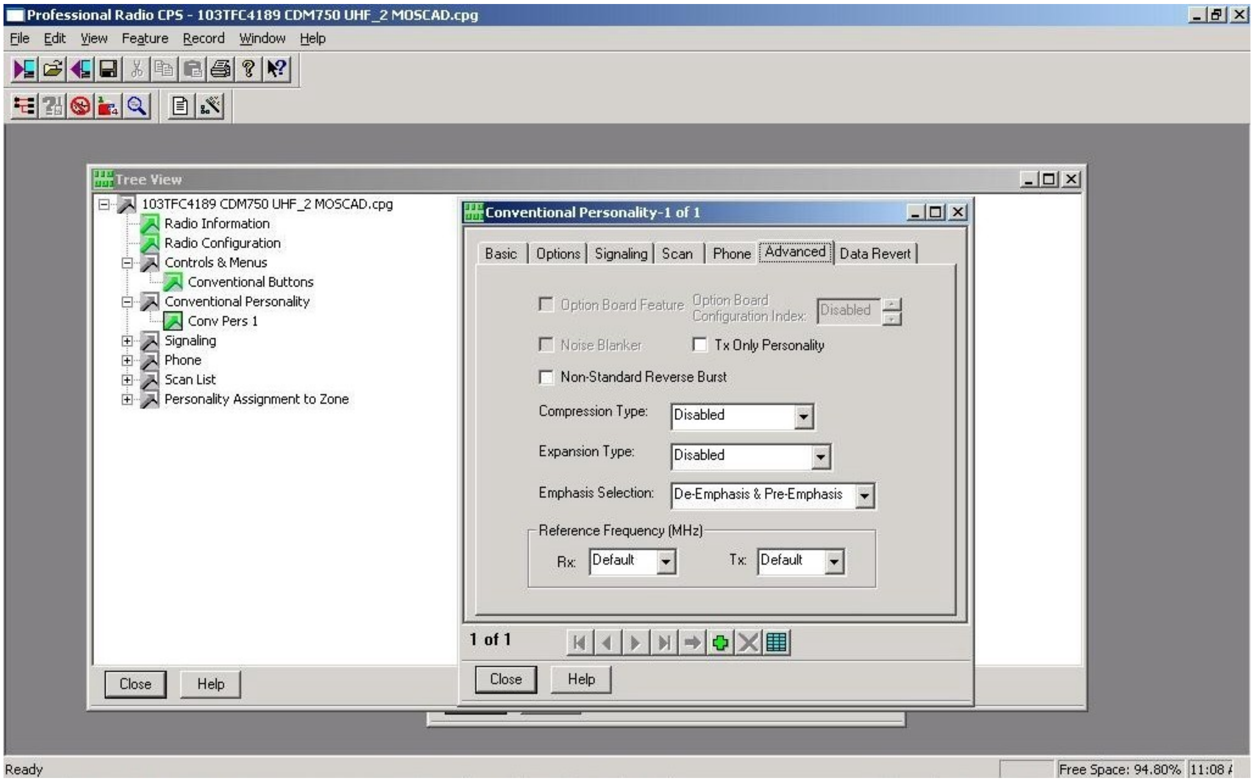


Figure 21-26 Conventional Personality Configuration – Advanced Settings

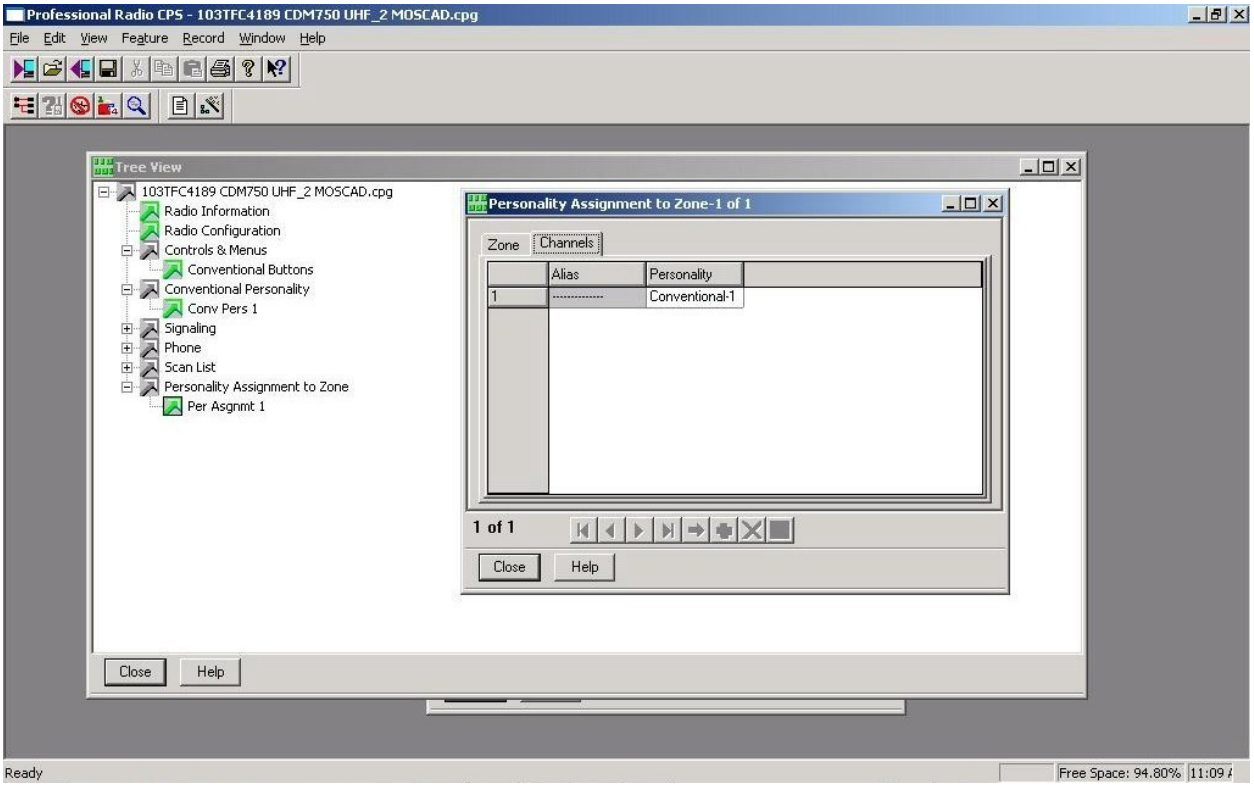


Figure 21-27 Radio Channel Assignment - Personality Assignment to Zone

GP/HT/PRO Radio Installation Kit

The GP/HT/PRO Radio Installation Kit for ACE3600 (V154AE, FLN3637A) enables the user to install the GP320/GP328/HT750/PRO5150 portable radios in ACE3600 Remote Terminal Units (RTU). Each kit includes a bracket, radio interface, adapters, and cables.

Volume Knob Retainer

The volume knob retainer sets a fixed position for the volume knob on the GP/HT/PRO radios, for optimal operation in an ACE3600 RTU installation. To implement this option, follow the procedure below.

Procedure 21-21 How to Attach the Volume Knob Retainer for the GP/HT/PRO Radio

1. Remove the original plastic volume knob cover from the radio by pulling it out with pliers, as shown in Figure 21-28.

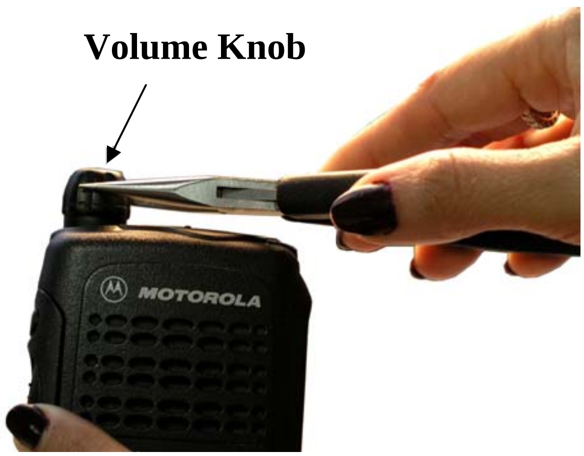


Figure 21-28 Removing the Volume Knob

2. Place the hole of the volume knob retainer (shown in Figure 21-29) over the exposed metal volume rod on the radio (shown in Figure 21-30.)

Figure 21-29 Volume Knob Retainer

3. Fasten the bottom of the volume knob retainer to the radio body. (See Figure 21-30.)

Figure 21-30 Attach Retainer to Radio

Installation

CAUTION

Before installing the GP/HT/PRO radio on the RTU, configure the power supply AUX2A/B connector to 7.5V DC in the ACE3600 STS site configuration (using the Power Supply <n> Auxiliary 2 voltage parameter.) Download the updated site configuration to the RTU. Failure to do this might damage the radio.

The GP/HT/PRO radio can be mounted on the ACE3600 RTU as follows:

1. Attach the radio plug-in port from the installation kit (FLN3696A) to the desired opening on the ACE3600 CPU module. For instructions on attaching plug-in ports, see Connecting Plug-In Ports to the CPU Module in the CPU Module chapter above.
2. Connect the audio accessory adapter (HLN9716) (Item 1) to the radio. See Figure 21-31.
3. Insert the communication cable (FKN8431A) (Item 2) into the audio accessory adapter.
4. Insert the BNC antenna adapter (FTN6045B) into the radio antenna connector (Item 3).
5. Snap the radio into the DC adapter (FCN5516B) (Item 4).
6. Insert the 7.5V DC power cable (FKN8515A) into the DC connector of the DC adapter (Item 5).

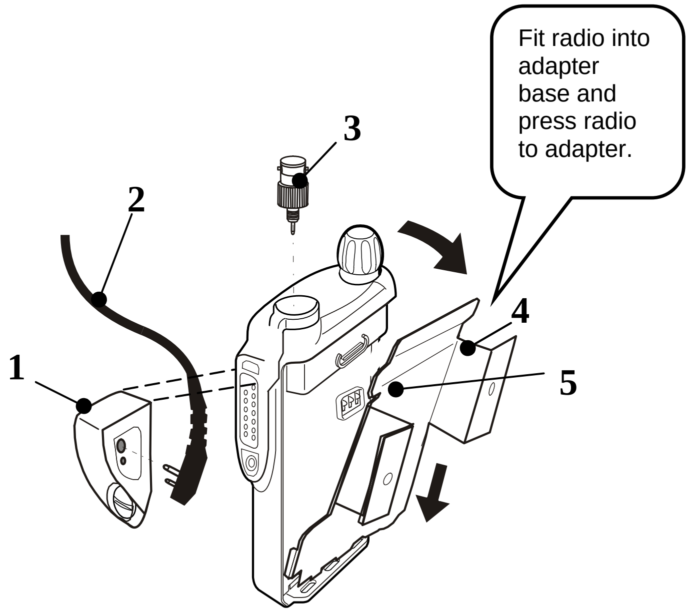


Figure 21-31 GP/HT/PRO Radio Installation

7. Using the two screws, attach the radio assembly to the radio bracket (FHN6899A).
8. Using the three screws on the bracket, attach the bracket with the radio to the chassis of the ACE3600. (See Figure 21-32.)
9. Connect the audio communication cable (FKN8431A) to the audio adapter (attached to the radio). Place one Fair-Rite soft ferrite (#7683477X01 from the supplied ferrite kit FHN7007A) on the cable near the bottom of the CPU door, loop the cable one turn around it, and clamp the ferrite on the cable. Connect the other end of the communication cable to the plug-in port on the front panel of the CPU module.
10. Connect the DC power cable (FKN8515A) from the DC adapter (attached to the radio) to the AUX2A or AUX2B connector of the power supply module.
11. Route the antenna cable (FKN8434A) from the bottom of the RTU box to the BNC adapter on the radio.
12. Use the clamps provided in the kit to route and secure the audio communication and DC power cables. (See Figure 21-32.)

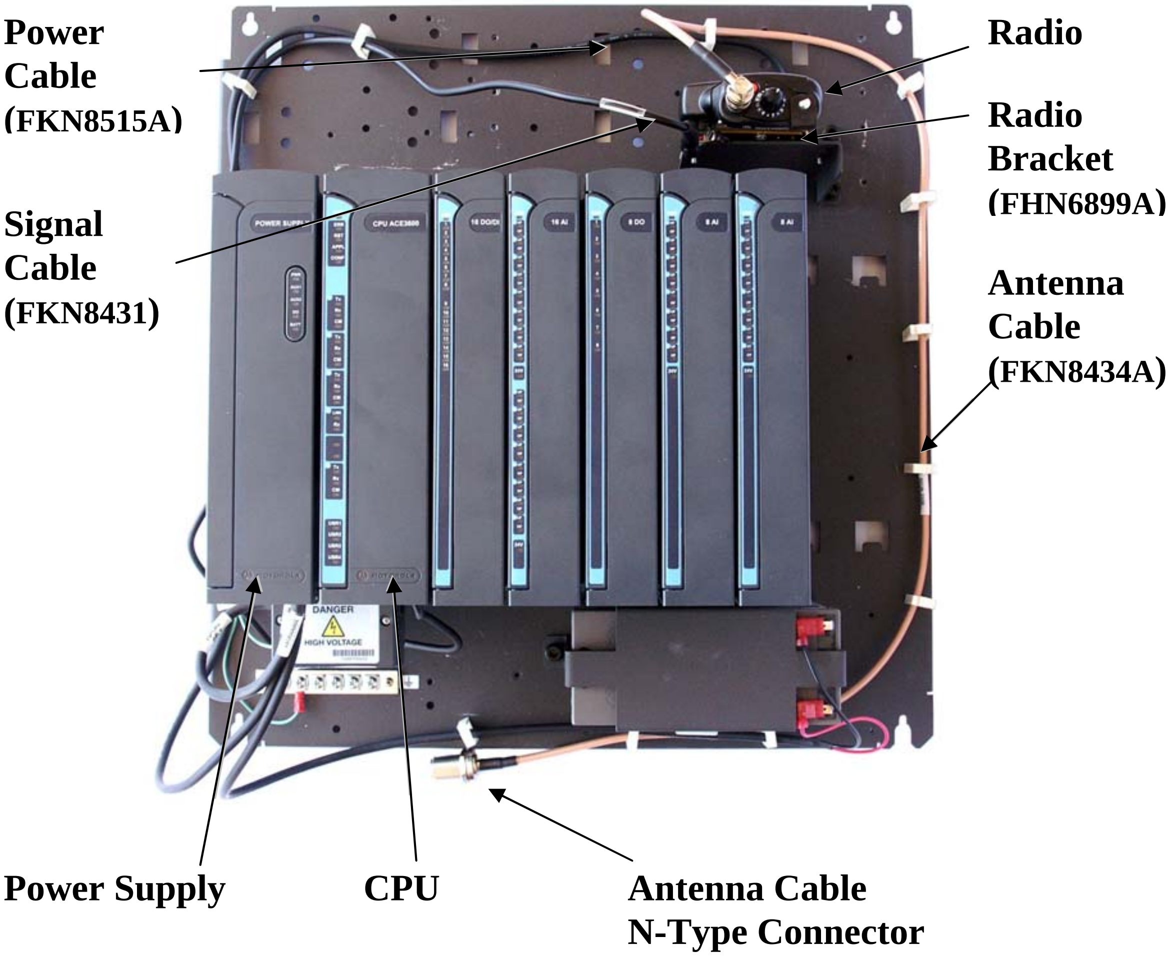


Figure 21-32 GP/HT/PRO Radio Installed on ACE3600 Chassis

RTU Port Configuration for the GP320/GP328/HT750/PRO5150 Radio

To enable MDLC communication using GP320/GP328/HT750/PRO5150 radios, use the ACE3600 STS site configuration utility to configure the ACE3600 RTU plug-in port connected to the radio.

The following figures show the port configuration and advanced parameter configuration. Although these show Port PI1, the same values can be applied to port PI2 as well, where relevant.

Port Type

Procedure 21-22 How to Configure the ACE3600 Port for the GP/HT/PRO Radio

1. In the ACE3600 STS click on the desired site, and open the site view.
2. In the Port Tab, click on the plug-in port through which the RTU will communicate with the radio.
3. Confirm that the port parameters and data speed are as shown in the screen below.

4. Define desired radio links and zones if necessary.

5. Save the changes. Generally no other changes are required to Advanced Physical or Link Layer parameters.

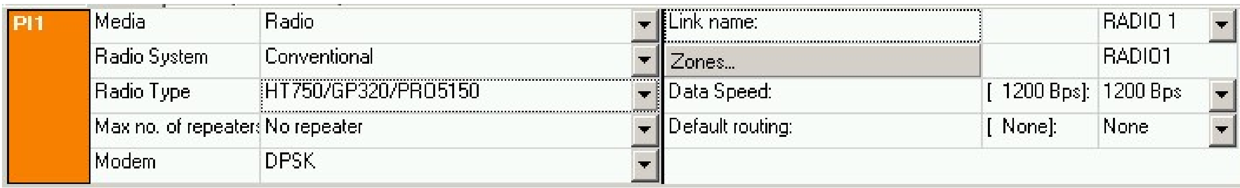


Figure 21-33 RTU Site Configuration for MDLC over GP320/GP328/HT750/PRO5150 Radio – Port Type Parameters

GP/HT/PRO Radio Models and Regional Options for ACE3600

The GP/HT/PRO models of the ACE3600 RTU, F7553A (VHF) and F7554A (UHF) include the following regional options:

Option	Region	Radio
V951	North America (NA)	HT750
V952	EMEA	GP320
V953	Asia	GP328
V954	Latin America (LA)	PRO5150
V154AE	GP/HT/PRO INSTALL KIT	
FLN3637A	GP/HT/PRO INSTALL KIT	

Note:

1. When ordering ACE3600 model with a GP/HT/PRO radio, a V95x option must be added.

2. For models/options availability, see the latest sales price list.

3. Orders to EMEA should be placed as model without radio and radio as a kit

CM/EM/GM Radio Installation Kit

The CM/EM/GM Installation Kit for ACE3600 (V148AC/FLN3635A) enables the user to install the CM/EM/GM mobile radio (CM200, CM140, EM200, GM3188) in ACE3600 Remote Terminal Units (RTU). Each kit includes a bracket, adapter, and cables.

Installation

The CM/EM/GM can be mounted on the ACE3600 RTU as follows:

Procedure 21-23 How to Install the CM/EM/GM Radio on the Metal Chassis

1. Attach the radio plug-in port from the installation kit (FLN3696A) to the desired opening on the ACE3600 CPU module. For instructions on attaching plug-in ports, see Connecting Plug-In Ports to the CPU Module in the CPU Module chapter above.
2. Connect the 16-pin connector radio adapter (FLN3636A) to the accessory connector on the radio. (See Figure 21-34.)

Figure 21-34 CM/EM/GM Radio, Adapter and Power Cable

3. Connect the power cable (FKN8428A) to the radio's power connector. (See Figure 21-34 and Figure 21-35.) Connect the other end of the power cable to the AUX1A or AUX1B connector on the ACE3600 RTU Power Supply unit. (See Figure 21-36.)

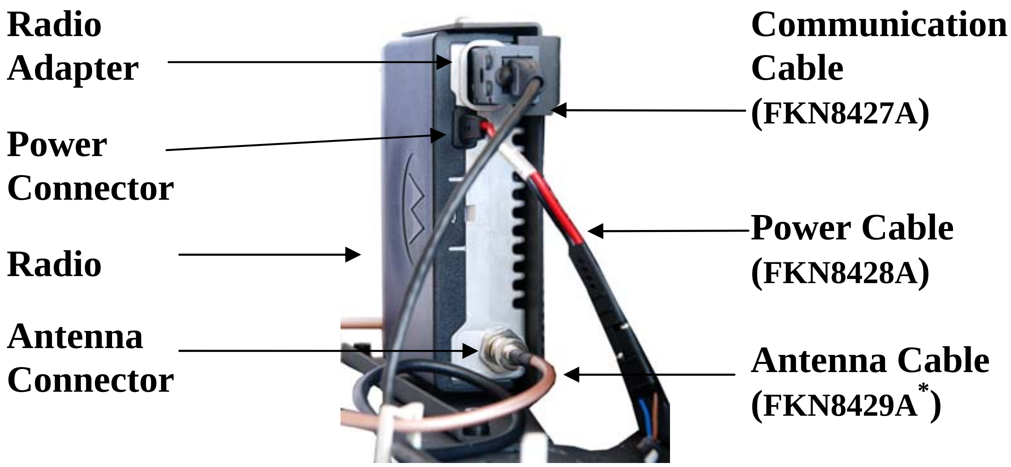


Figure 21-35 CM/EM/GM Radio Cable Connections

4. Connect the communication cable (FKN8427A) to the back of the radio adapter (FLN3636A) connector (10-pin RJ45 connector). (See Figure 21-35.) Place one Fair-Rite soft ferrite (#7683477X01 from the supplied ferrite kit FHN7007A) on the cable near the bottom of the CPU door, loop the cable one turn around it, and clamp the ferrite on the cable. Connect the other end of the communication cable to the plug-in port of the ACE3600 CPU.

5. Mount the CM/EM/GM radio onto the metal bracket (#0789422V45) using the two supplied radio mounting screws from kit FHN6894A, # 0387839V89 on the top and bottom of the radio. (See Figure 21-34, Figure 21-35 and Figure 21-36.)

6. Connect the antenna cable (FKN8429A[*]) to the antenna connector on the radio and to the opening on the bottom of the ACE3600 housing using the four supplied screws. (See Figure 21-35 and Figure 21-36.) Mount the complex (bracket and radio) on the RTU chassis above the CPU and I/O modules, using the four built-in screws. (See Figure 21-36.)

[*] In EMEA and Asia, add the adapter provided in kit FLN3635A to the radio before attaching the antenna cable.

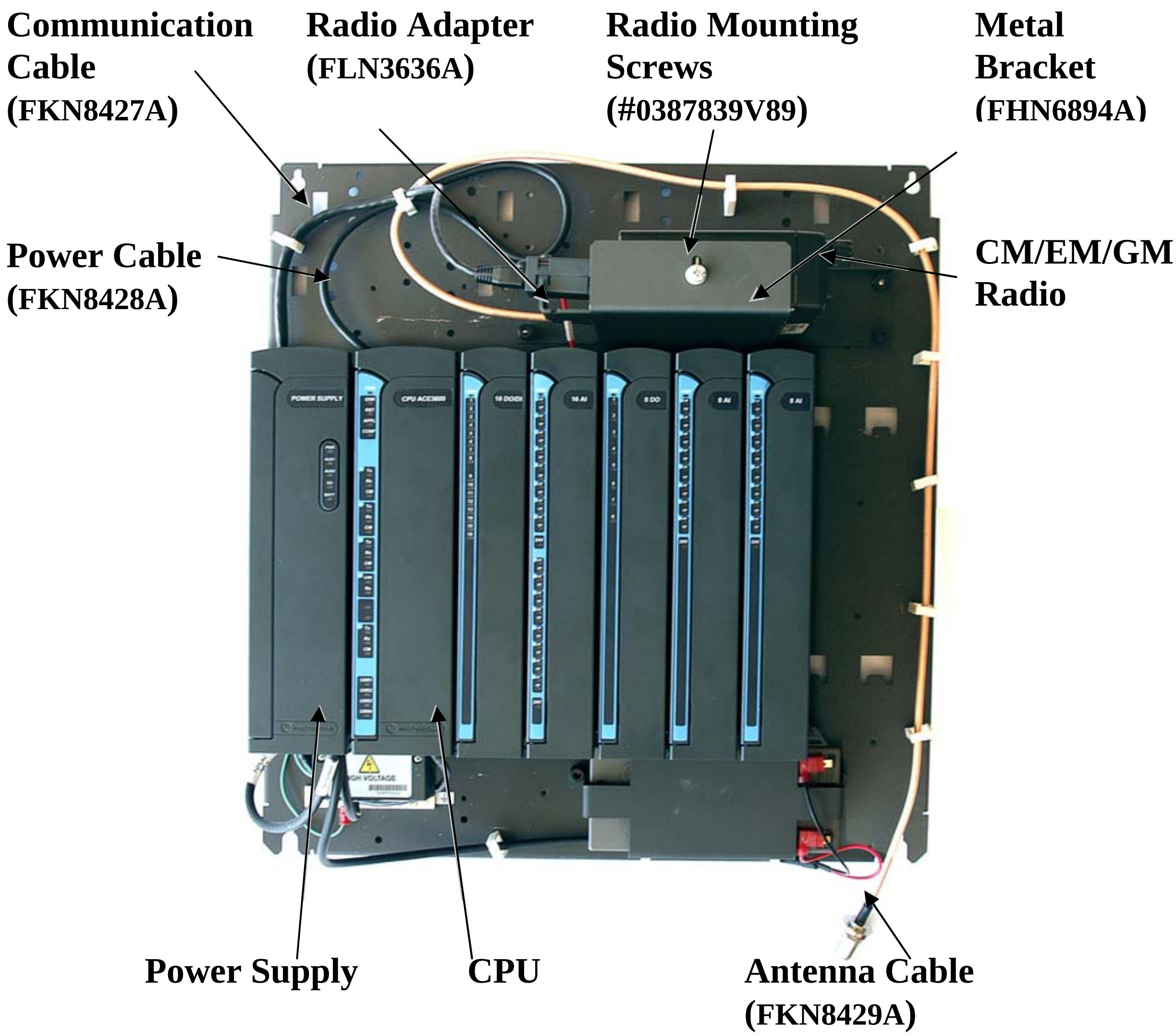


Figure 21-36 CM/EM/GM Radio Installed on ACE3600 Chassis

RTU Port Configuration for the CM/EM/GM Radio

To enable MDLC communication using CM/EM/GM radios, use the ACE3600 STS site configuration utility to configure the ACE3600 RTU plug-in port connected to the radio.

Follow the instructions for RTU Port Configuration for the CDM750 Radio above.

Programming the CM/EM/GM Radio using CPS

The following programming instructions must be performed before connecting a CM/EM/GM radio to an ACE3600 RTU. These steps define miscellaneous settings and the function of each pin in the radio's general purpose I/O connector.

Radio Information

The picture below shows the radio model information screen in the CPS.

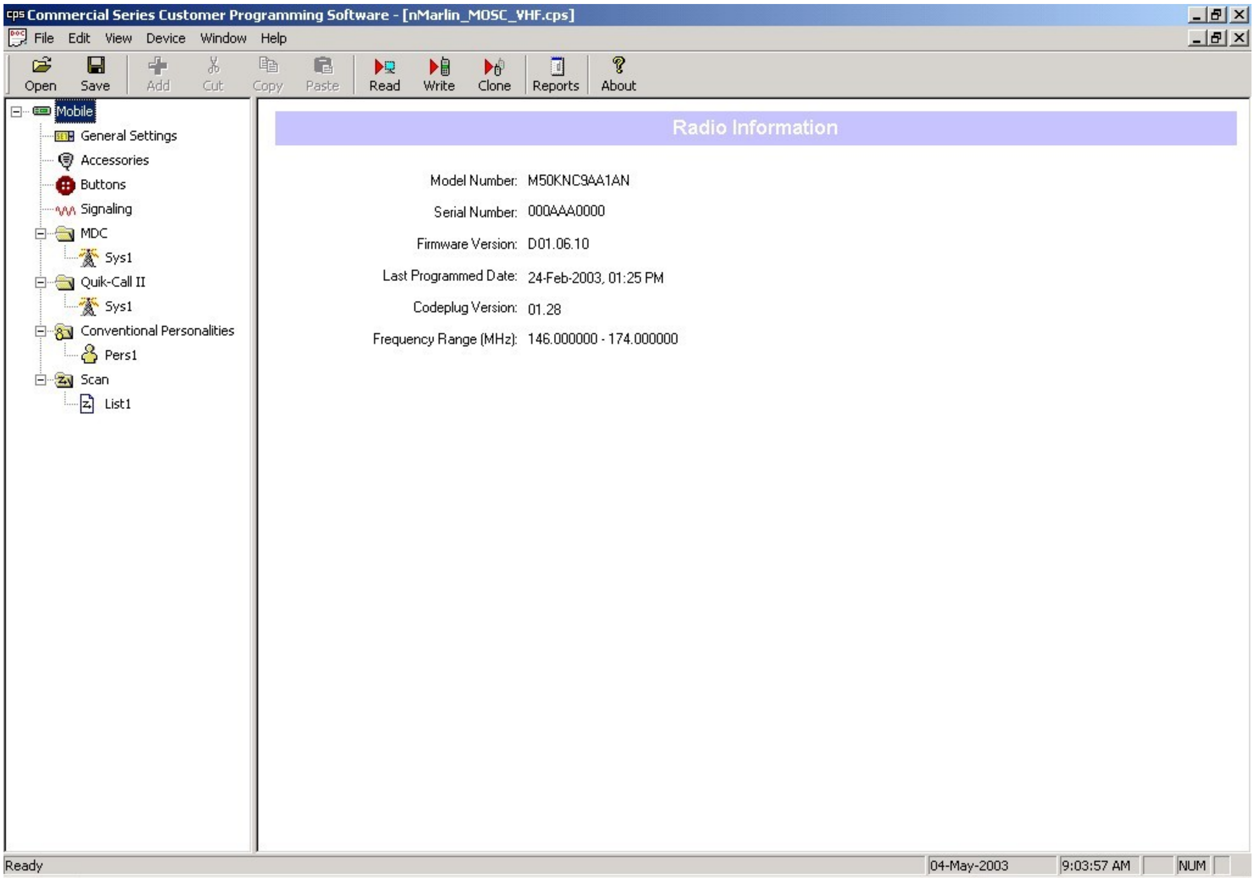


Figure 21-37 CM/EM/GM CPS Radio Information Screen

Radio Power Settings

The picture below shows the TX power setting (1-25 W) in CPS.

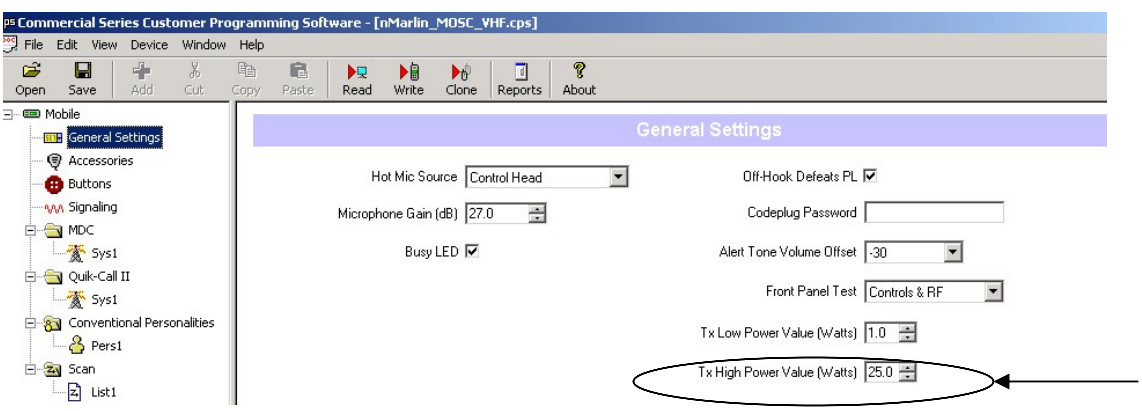


Figure 21-38 CM/EM/GM CPS General Settings Screen

Radio Accessory Connector Pins Definition

The picture below shows the setting of the radio's accessories pins required for interfacing with the ACE3600.

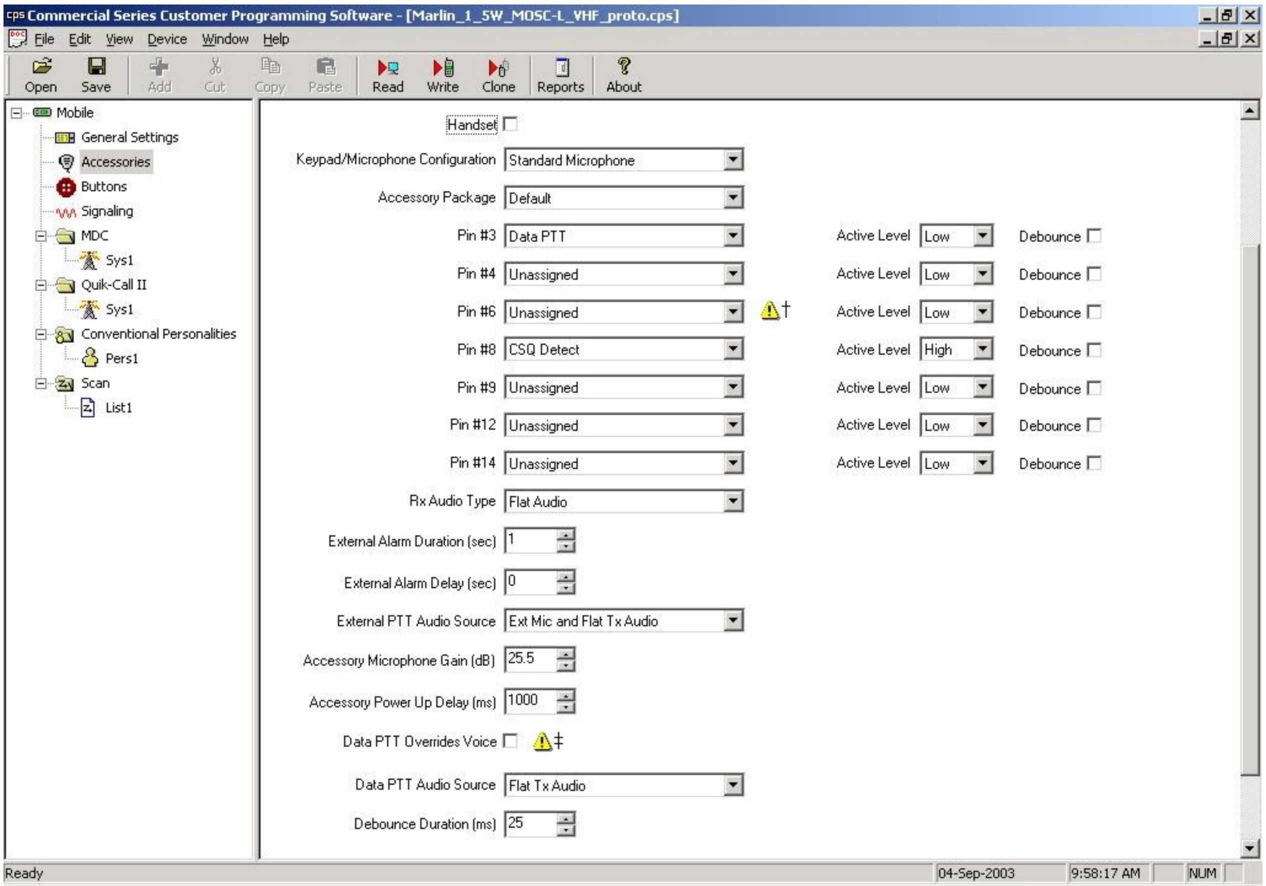


Figure 21-39 CM/EM/GM CPS Radio Accessories Screen

Frequency and Bandwidth Settings

The picture below shows the setting of the radio's frequency, bandwidth and power level.

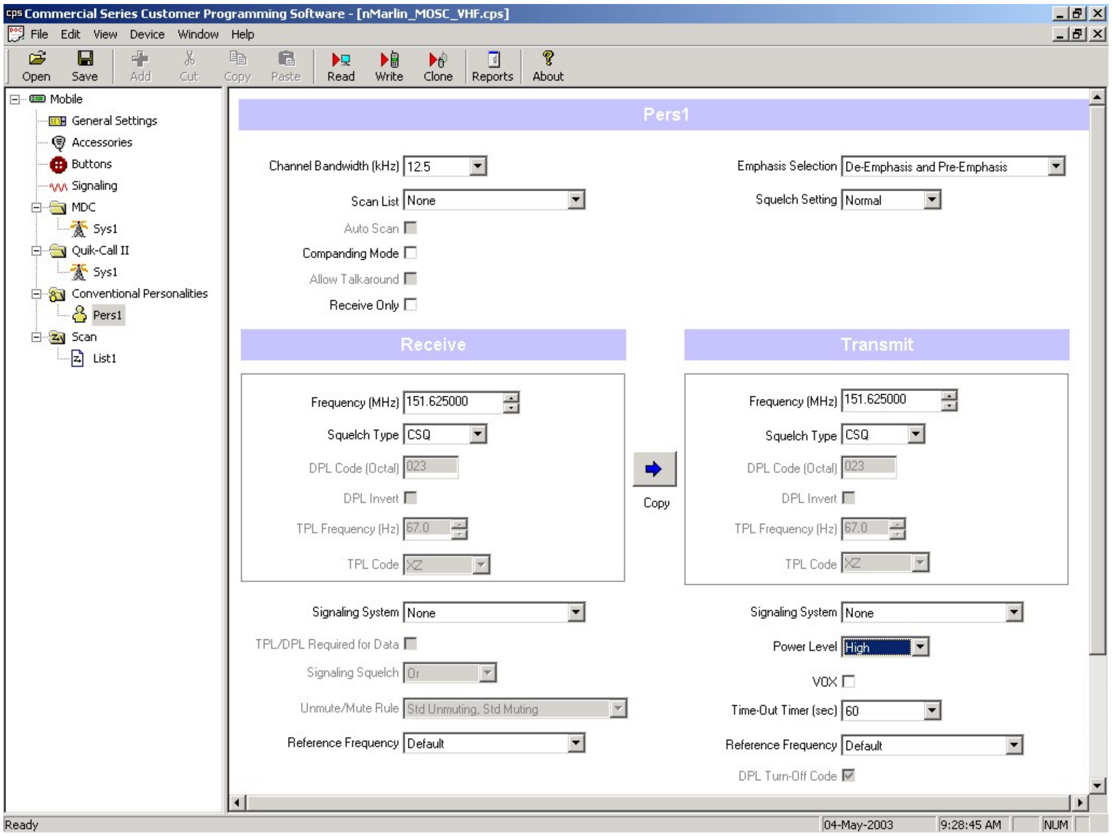


Figure 21-40 CM/EM/GM CPS Radio Personality Tx/Rx Screen

Note: The Power Level should be set according to the power output.

CM/EM/GM Radio Models and Regional Options for ACE3600

The CM/EM/GM models of the ACE3600 RTU, F7573A (VHF) and F7574A (UHF) include the following regional options:

Option	Region	Radio
V851	North America (NA)	CM200, 1-25W
V852	EMEA	CM140, 1-25W
V853	Asia	GM3188, 1-25W
V854	Latin America (LA)	EM200, 1-25W
V148AC	CM/EM/GM INSTALL KIT	
FLN3635A	CM/EM/GM INSTALL KIT	

Note:

1. When ordering an ACE3600 model with a CM/EM/GM radio, a V95x option must be added.
2. For models/options availability, see the latest sales price list.
3. The kit FLN3635A includes an adapter for use with antenna cable FKN8429A in EMEA and Asia.

MotoTrbo - XPR4350, XPR4380, DM3400, XiR M8220, DGM4100 Radio Installation Kit

The MotoTrbo - XPR4350, XPR4380, DM3400, XiR M8220, DGM4100 Installation Kit for ACE3600 (FLN4102A/V682AF) enables the user to install the XPR4350/XPR4380/ DM3400/XiR M8220/DGM4100 mobile radios in ACE3600 Remote Terminal Units (RTU). Each kit includes a radio bracket (FHN6894A), power cable (FKN8436A), USB data cable (FKN8644A) and antenna cable (FKN8429A).

Installation

The MotoTrbo can be mounted on the ACE3600 RTU (CPU 3680 only) as follows:

1. Attach the MotoTrbo radio to the metal bracket (p/n 0789422V45 from kit FHN6894A) using the two supplied radio mounting screws. (See Figure 21-41.)

Figure 21-41 MotoTrbo Radio and Metal Bracket

2. Connect the USB connector of the USB data cable (FKN8644A) to one of the USB host ports on the ACE3600 CPU module. Connect the other side of the cable (26-pin connector) to the Accessory connector on the radio. (See Figure 21-42.)

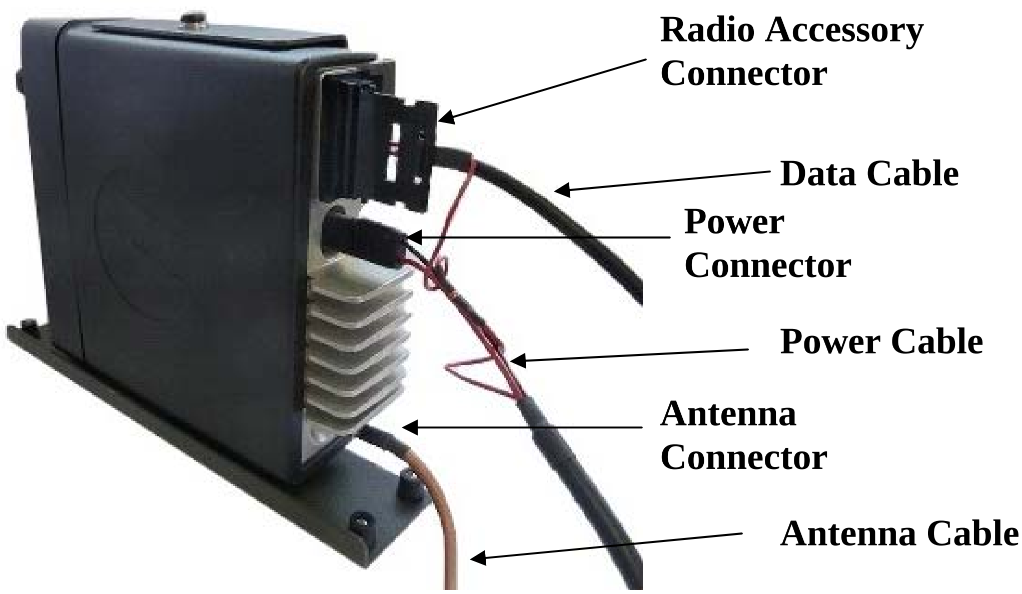


Figure 21-42 MotoTrbo Radio Cable Connections

3. Connect the DC power cable (FKN8436A) to the Power connector on the radio. Connect the male pin on the data cable (FKN8644A) to the female pin on the DC power cable (FKN8436A) to ensure ignition sense operation. Connect the opposite end of the power cable to the AUX1A or AUX1B connector on the ACE3600 power supply unit. Important: Only one MotoTrbo radio can be attached to a given power supply.
4. Mount the radio/bracket unit onto the RTU chassis above the CPU and I/O modules, using the four built-in screws. (See Figure 21-47.)
5. Connect the antenna cable (FKN8429A) to the Antenna connector on the radio. If the radio type is DM4300 (EMEA) or XIR M8220 (Asia), use the RF adapter 5871143Y01.
6. Run the cable through the small white clips along the edge of the chassis and attach the connector to the opening on the bottom of the ACE3600 RTU housing.

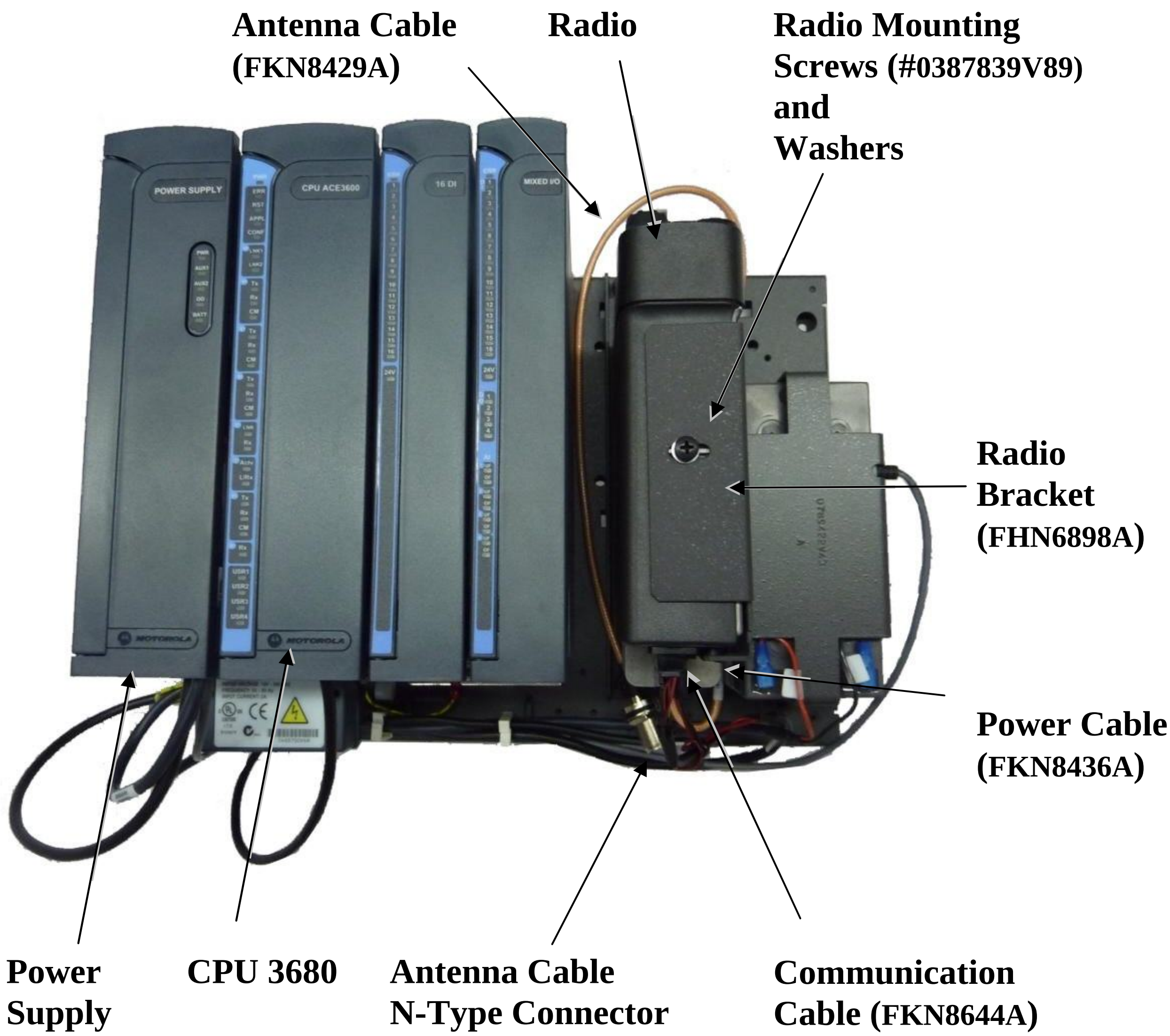


Figure 21-43 MotoTrbo Radio Installed on ACE3600 Chassis

RTU Port Configuration for the MotoTrbo Radio

The RTU port is configured using the ACE3600 STS as follows:

Port Type

Procedure 21-24 How to Configure the ACE3600 Port for the MotoTrbo Radio

1. In the ACE3600 STS, click on the desired site, and open the site view.
2. In the Port Tab, click on the USB port (HU1/HU2) through which the RTU will communicate with the radio. (HU1 is the left USB port and HU2 is the right USB port.)
3. Confirm that the port parameters are as shown in the screen below.

4. Define the desired Line links.

5. Save the changes. Generally no other changes are required to Advanced Physical or Link Layer parameters.

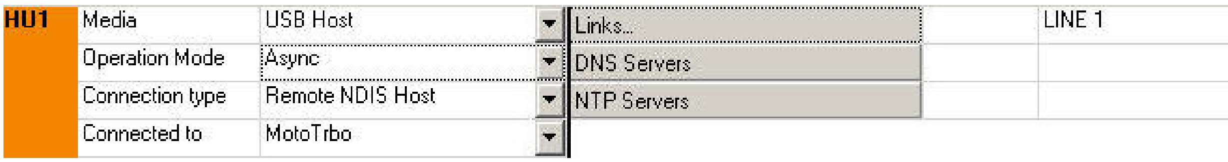


Figure 21-44 RTU Site Configuration for MDLC over MOTOTRBO Radio – Port Type Parameters

Advanced Parameter Configuration

The STS provides default settings for advanced port parameters for use with the MotoTrbo radio. These settings should be used.

Programming the MotoTrbo Radio using CPS

The MotoTrbo radio is programmed for ACE3600 in the factory and is ready for communication. For user programming of site-specific parameters, bring the radio to the Motorola Service Center or use the CPS which can be ordered with the radio and follow the instructions below.

Radio Connections

To program the MotoTrbo radio with Customer Programming Software (CPS), the radio is connected to a PC USB port using the standard ACE3600 MotoTrbo communication cable FKN8644A.

Procedure 21-25 How to Connect the MotoTrbo Radio to the CPS

1. Connect the 26-pin connector to the radio Accessory connector, and the USB connector to the PC on which the MotoTrbo CPS software is installed.

2. Connect the power cable to the radio.

Radio Disassembly

If the MotoTrbo radio is to be programmed outside of the ACE3600 housing, disassemble the radio as follows:

Procedure 21-26 How to Disassemble the MotoTrbo Radio from the ACE3600 Metal Chassis

1. Disconnect the antenna cable (FKN8429A) from the radio Antenna connector.

2. Remove the radio/bracket unit from the RTU chassis by unscrewing the four built-in screws.

3. Disconnect the DC power cable (FKN8436A) from the radio Power connector.

4. Disconnect the data cable (FKN8644A) from the radio.

5. Detach the metal bracket (FHN6894A) by unscrewing the two radio screws (#0387839V89), one on each side. (See Figure 21-15.)

CPS Programming Settings

The following programming instructions must be performed before connecting a MotoTrbo radio to the ACE3600 family Remote Terminal Units (RTU). These instructions define miscellaneous settings and the function of each pin in the radio's general purpose I/O connector.

Procedure 21-27 How to Program the MotoTrbo Radio

1. Before programming the radio, read the codeplug file from the radio and save it to your PC using the File >Read Device command in the CPS.
2. Open the codeplug file in the CPS. Verify that you are using the right radio.
3. Under the radio's General Settings, change the Radio ID number as required and the TX High Power value to VHF 25W/UHF 20W. (View->Expert displays the full layout of General Settings.)
4. Under Accessories, verify that Ignition Sense is set to On/Off Or Ignition.
5. Under Network, verify that the CAI Network number (default 12) is identical for all radios in the system.
   Verify that CAI group number (default 225) is identical for all radios in the system.
   Verify that the Forward to PC window is marked enabled (required for time sync and broadcast).
6. Under Channels->Zone<n>->Channel1, set the TX and RX frequencies as required. Verify that the color code and the repeater slot are equal in all radios in the group.
7. From the File Menu, select Save to save changes to the radio.
8. From the File Menu, select Write Device to download the configuration to the radio.

Note: The radio configuration must match the repeater topology (direct mode, single repeater, IP site connect.)

For more information on configuring the MotoTrbo radio and the ACE3600 RTUs for MDLC over MotoTrbo, see the MDLC over MotoTrbo section of the ACE3600 STS Advanced Features manual. For information on adding IP addresses to the IP conversion table and downloading to the relevant attached RTUs, see the Operation chapter of the ACE3600 STS User Guide.

XPR4350/XPR4380/DM3400/XiR M8220/DGM4100 Options for ACE3600

One of the following MotoTrbo options must be ordered with the F7583A/F7584A models:

Option Name	Option Number
ADD: XPR4350 Radio 403-470 MHz for NAG	V751AA
ADD: XPR4350 Radio 450-512 MHz for NAG	V751AB
ADD: XPR4350 Radio 136-174 MHz for NAG	V751AC
ADD: XPR4380 Radio 800/900 MHZ FOR NAG	V751AD
ADD: DM3400 Radio 403-470 MHz for EMEA & Australia	V752AA

ADD: DM3400 Radio 450-527 MHz for EMEA & Australia	V752AB
ADD: DM3400 Radio 136-174 MHz for EMEA & Australia	V752AC
ADD: XiR M8220 Radio 403-470 MHz for Asia	V753AA
ADD: XiR M8220 Radio 450-512 MHz for Asia	V753AB
ADD: XiR M8220 Radio 136-174 MHz for Asia	V753AC
ADD: DGM4100 Radio 403-470 MHz for LA	V754AA
ADD: DGM4100 Radio 450-527 MHz for LA	V754AB
ADD: DGM4100 Radio 136-174 MHz for LA	V754AC

TransNET 900 OEM Radio Installation Kit

The TransNET™ 900 OEM radio installation kit (VA00225AA/FLN3852A) enables the user to install MDS TransNET 900 OEM (board version) radio modems in ACE3600 Remote Terminal Units (RTU). Each kit includes a bracket, adapter, and cables.

Installation

The TransNET 900 radio modem is housed in a plastic housing, as shown below:

Figure 21-45 TransNET 900 Radio Modem and Connectors

The TransNET 900 can be mounted on the ACE3600 RTU as follows:

Procedure 21-28 How to Install the TransNET 900 Radio on the Metal Chassis

1. Attach the TransNET 900 radio modem to the metal bracket (#0789971V39 from FHN7067A) using the four supplied screws, inserting the screws from above. (See Figure 21-46 below.)

Figure 21-46 TransNET 900 Radio Modem Mounted on Metal Bracket - Front and Rear View

2. Mount the bracket on the RTU chassis above the I/O modules, using the four built-in screws. (See Figure 21-47 and Figure 21-48 below.)

3. Connect one end of the power cable (FKN8508A) to the TransNET's PWR (9-30VDC) connector and tighten the attached screws. Connect the other end of the cable to the AUX1A connector on the RTU's power supply module.

4. Connect one end of the data cable (FKN8514A) to the TransNET's DATA connector using the attached screws. Connect the other end of the communication cable to the ACE3600 CPU module port configured for the radio.

5. Connect the small end of the antenna cable (FKN8511A) to the TransNET's ANT (Antenna) connector.
   Unscrew the nut and locking washer from the other end of the antenna cable.
   If the RTU is inside an enclosure, thread the end of the cable through the opening on the bottom of the enclosure and screw on the nut and locking washer from outside the enclosure.

6. Connect the antenna cable to an external antenna.

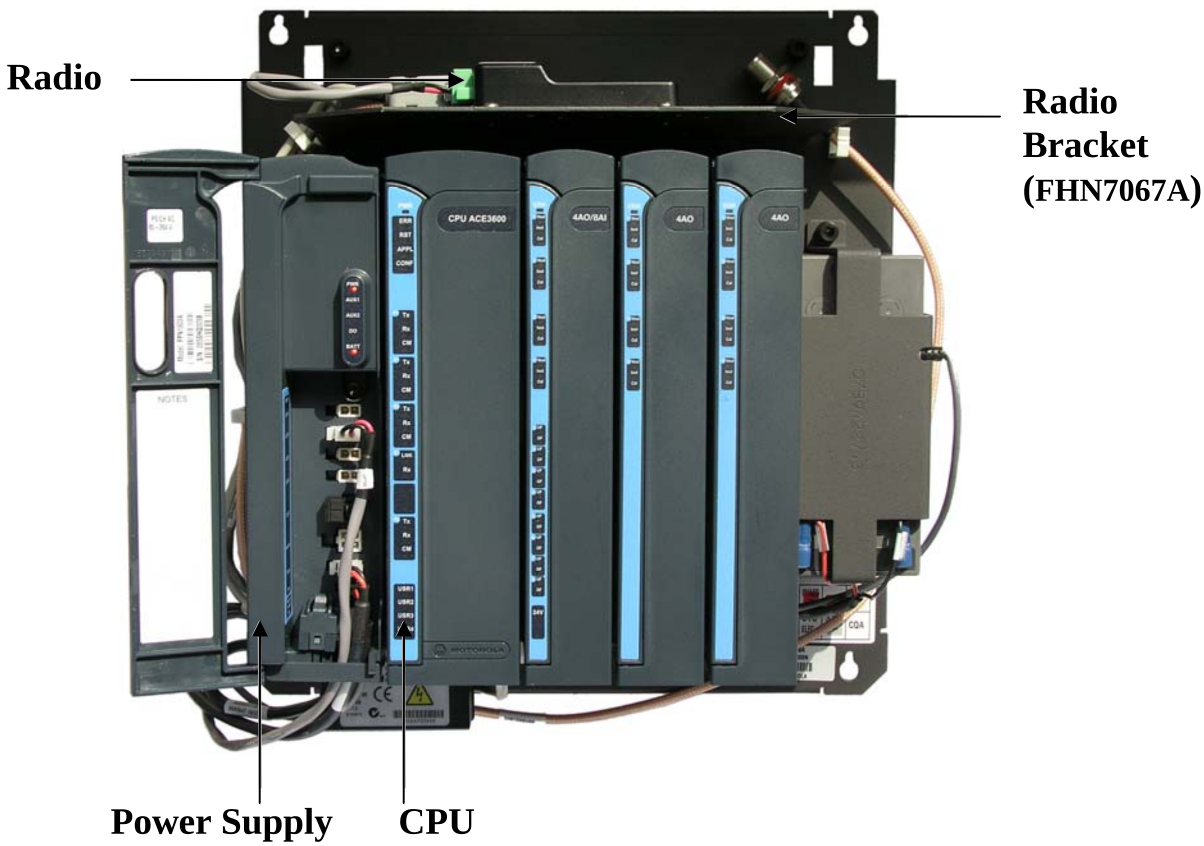


Figure 21-47 TransNET 900 Radio Modem Installed on ACE3600 Chassis

Figure 21-48 TransNET 900 Radio Modem Installed on ACE3600 Chassis – Cable Connections

Setting Radio Parameters

The TransNET 900 radio has certain parameters which are set in the MDS factory.

- The radio address ADDR = xx, where xx is the same number for all radios in the system The address appears on the radio itself.
- Mode - either MASTER or REMOTE (Slave). The mode setting appears on the radio itself.
- Baud rate (factory default = 9600 8N1)

These radio settings are determined in the MDS factory and are not generally changed by the user. If it is necessary to change these settings, refer to the TransNET 900 radio documentation.

RTU Configuration

The RTU port is configured using the ACE3600 STS as follows:

Procedure 21-29 How to Configure the ACE3600 Port for the TransNET 900 Radio

1. In the ACE3600 STS click on the desired site, and open the site view.

2. In the Port Tab, click on the on-board or plug-in port through which the RTU will communicate with the TransNET radio.

3. Confirm that the port parameters and data speed are as shown in the screen below. Note: If the baud rate of the radio is not the default value (9600), the baud rate of the port should be configured accordingly.

4. Define desired links.

5. Save the changes.

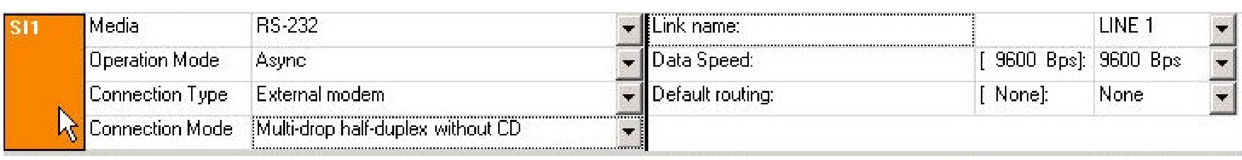


Figure 21-49 RTU Site Configuration for TransNET Radio– Port Type Parameters

iNET 900 Radio Installation Kit

The iNET™ 900 installation kit (V680AH/FLN3854A) enables the user to install MDS iNET 900 (board version) radio modems in ACE3600 Remote Terminal Units (RTU). Each kit includes a bracket, adapter, and cables.

Installation

The iNET 900 radio modem is housed in a plastic housing, as shown below:

Figure 21-50 iNET 900 Radio Modem

The iNET 900 can be mounted on the ACE3600 RTU as follows:

Procedure 21-30 How to Install the iNET 900 Radio on the Metal Chassis

1. Attach the iNET 900 radio modem to the metal bracket (#0789971V39 from FHN7067A) using the four supplied screws, inserting the screws from below. (See Figure 21-51 below.) Note: The radio must be placed in the bracket with the connectors to the left side, so that the bracket can be mounted on the RTU chassis and the cables can reach the CPU.

Figure 21-51 iNET 900 Radio Modem Mounted on Metal Bracket – Front and Rear View

2. Mount the bracket on the RTU chassis above the I/O modules, using the four built-in screws. (See Figure 21-52 below.)

3. Connect one end of the power cable (FKN8508A) to the iNET's PWR connector and tighten the attached screws. Connect the other end of the cable to the AUX1A connector on the RTU's power supply module. See Figure 21-52 and Figure 21-53 below.)

4. Connect one end of the data cable (FKN8512A) to the iNET's COM2 connector using the attached screws. Connect the other end of the communication cable to the ACE3600 CPU module port configured for the radio.

5. Connect the small end of the antenna cable (FKN8511A) to the iNET's ANT (Antenna) connector.
   Unscrew the nut and locking washer from the other end of the antenna cable.
   If the RTU is inside an enclosure, thread the end of the cable through the opening on the bottom of the enclosure and screw on the nut and locking washer from outside the enclosure.

6. Connect the antenna cable to an external antenna.

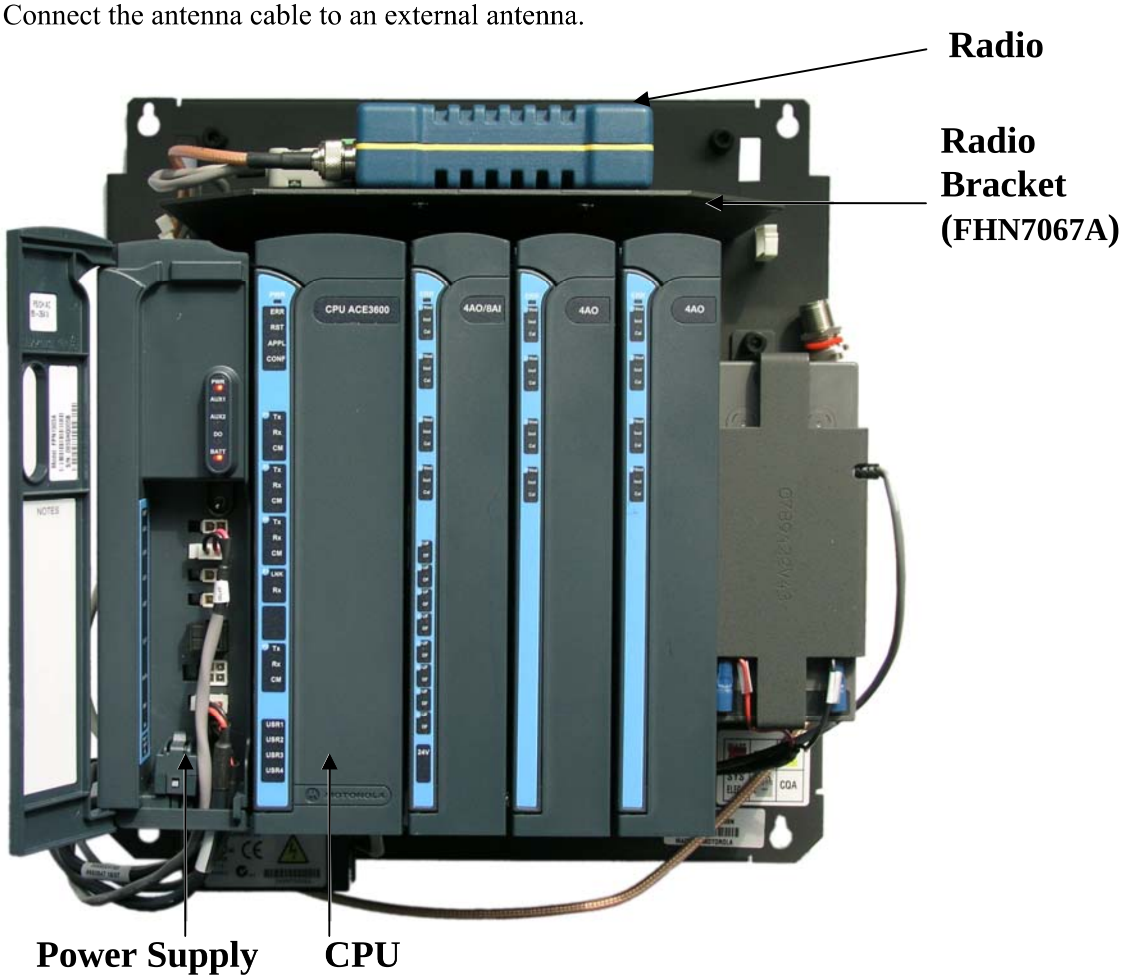


Figure 21-52 iNET 900 Radio Modem Installed on ACE3600 Chassis

Figure 21-53 iNET 900 Radio Modem Installed on ACE3600 Chassis – Cable Connections

Configuring the iNET 900 to Work with ACE3600

The iNET 900 radio modem can be configured to work with ACE3600 RTUs in several ways as described below. Configurations 1-3 below represent External Modem configurations. Configurations 4-7 represent MDLC over IP configurations.

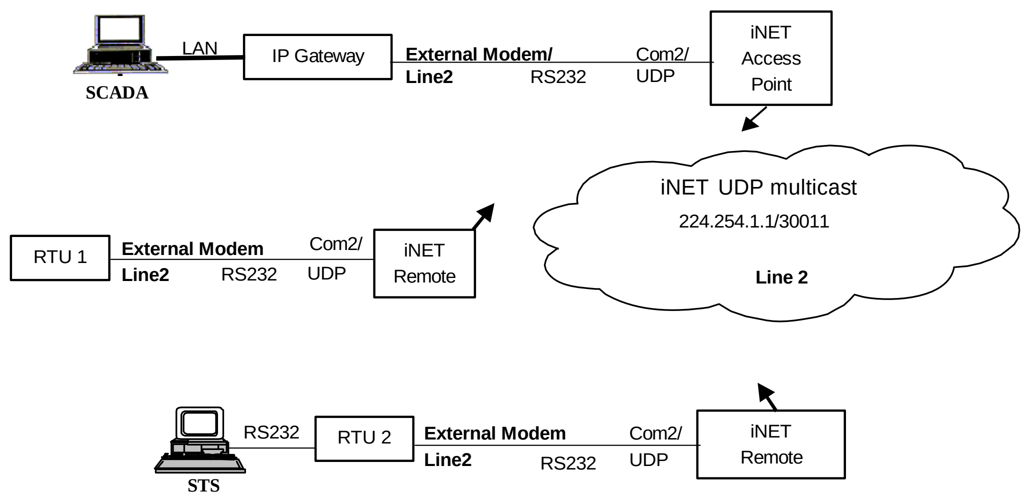
With iNET radios (firmware version ≥ V4.4.0) any remote can communicate with any other remote. An MDLC network (with zones) is no longer needed. The iNET should be set in Multipoint to Multipoint topology, in order to enable communication between RTUs with no zones.

Notes:

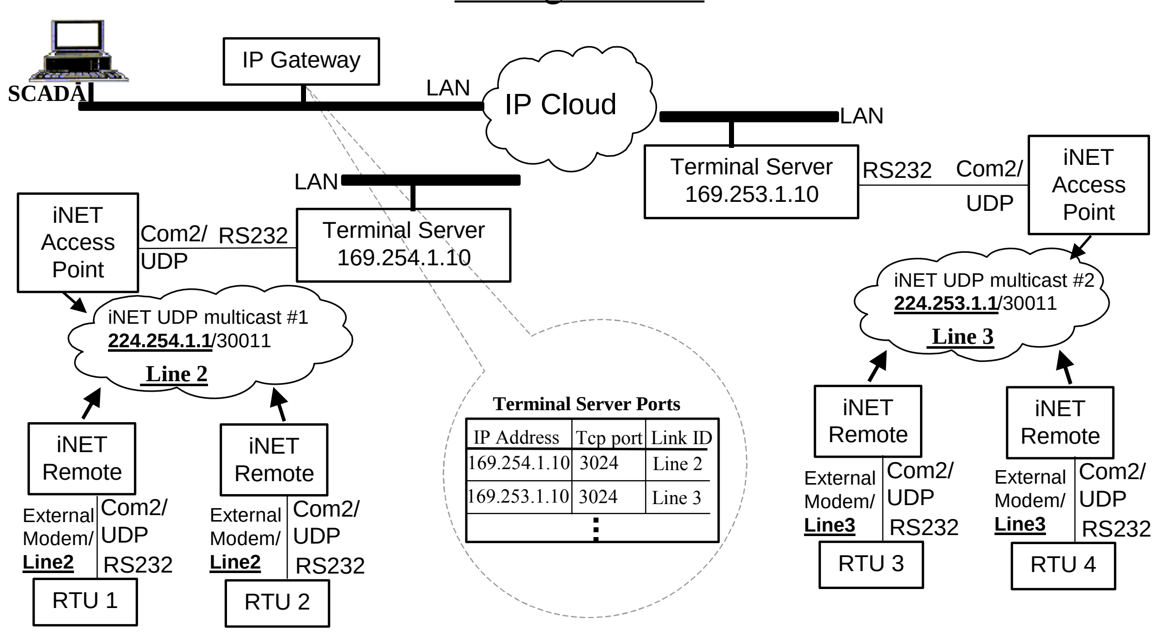
- It is recommended to enable flow control on the RS232 serial port.
- An RTU configured for MDLC over IP cannot communicate with an RTU configured for External Modem over the iNET network. If both exist, they should be allocated different Link IDs.

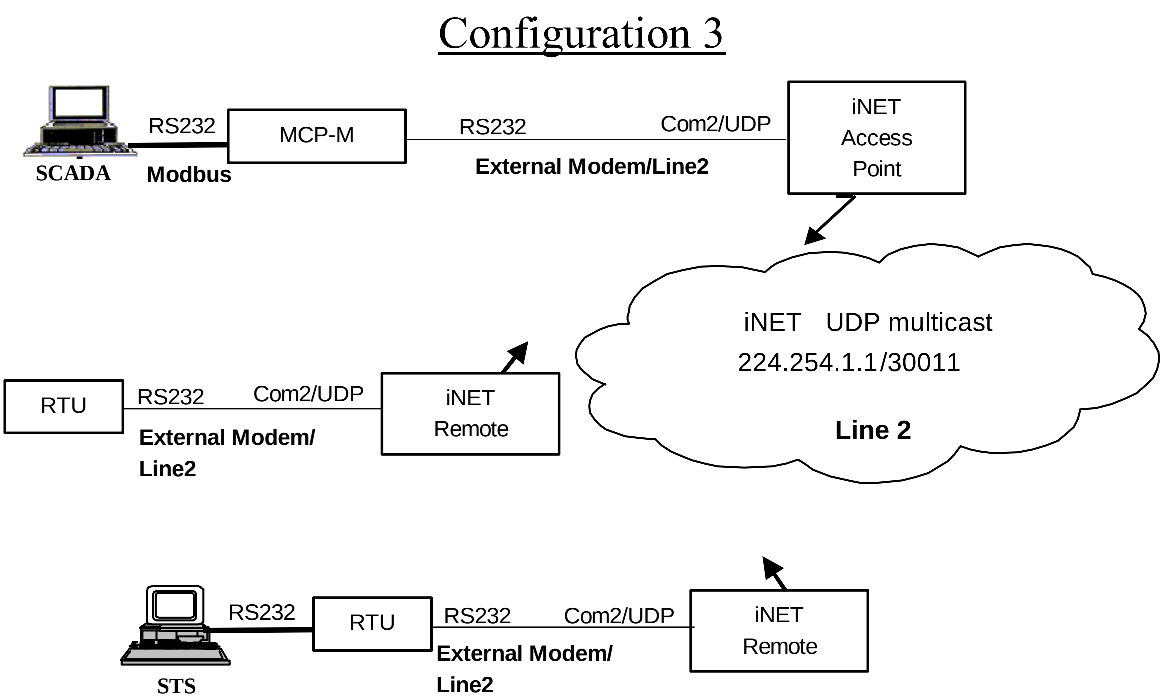
External Modem Port Configurations

Configuration 1

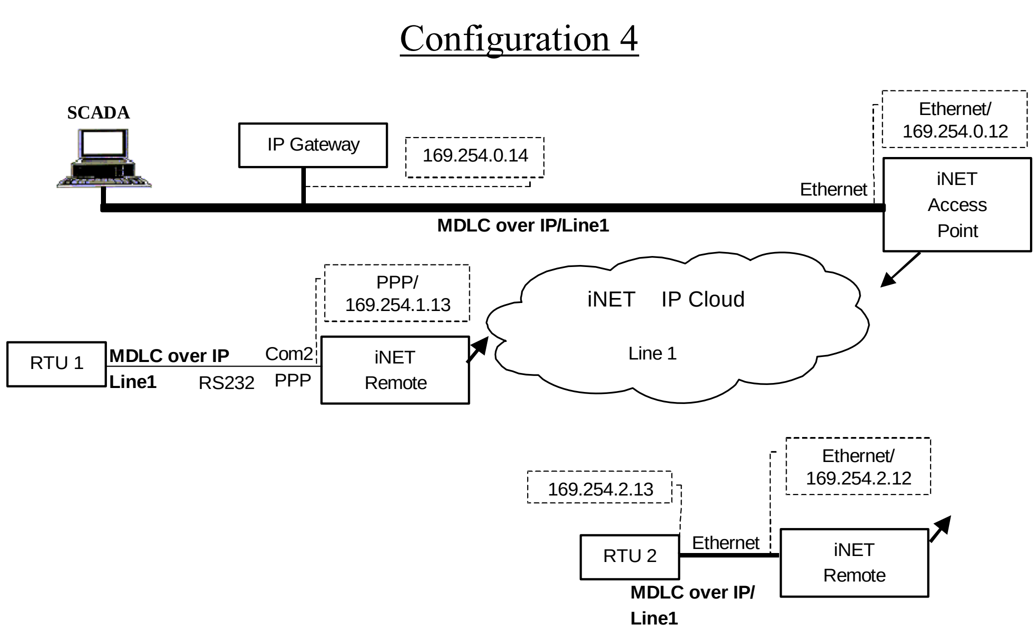


Configuration 2

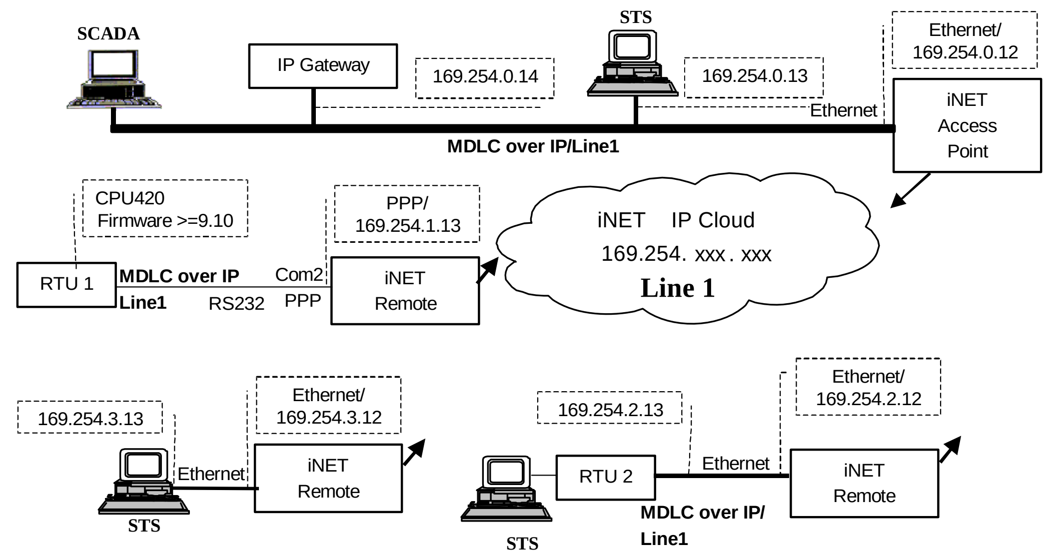




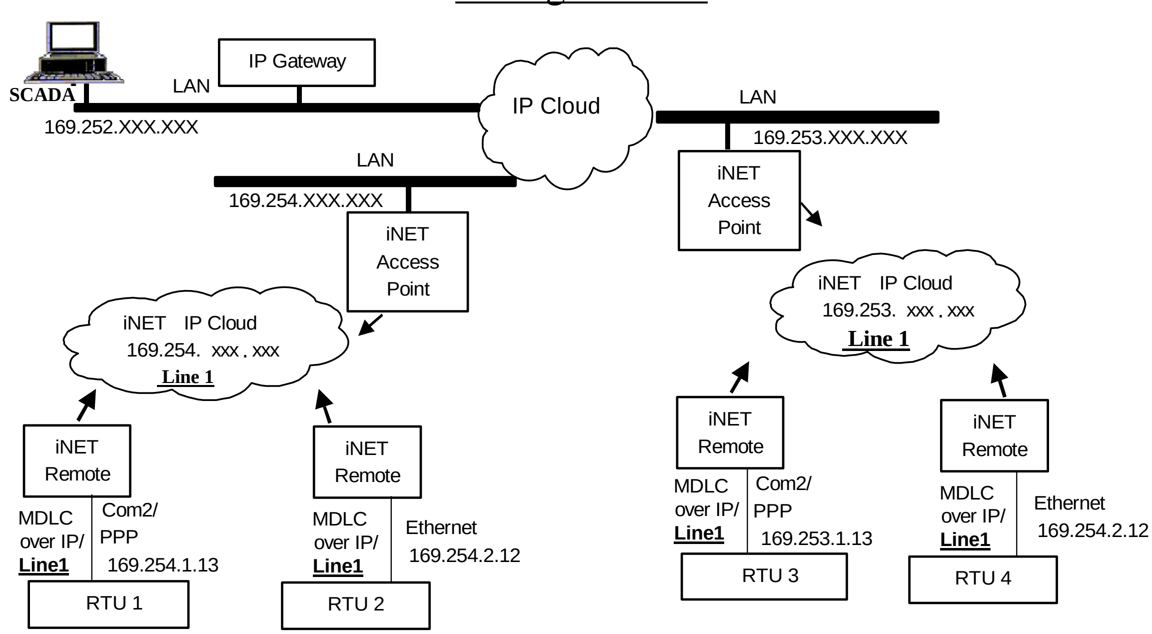
MDLC over IP Port Configurations



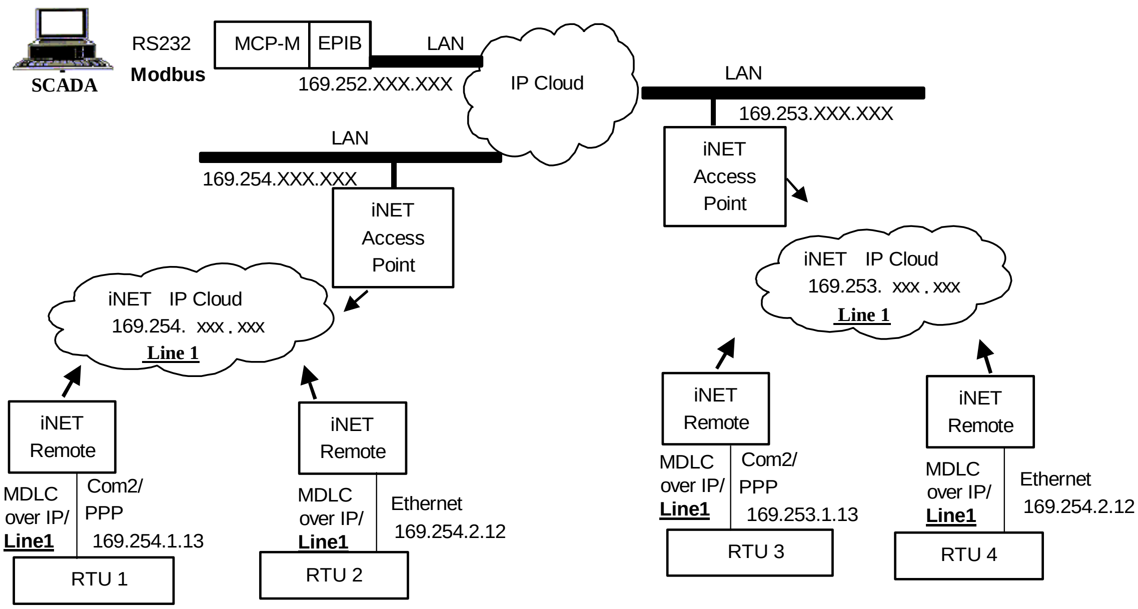
Configuration 5



Configuration 6



Configuration 7



Radio Configuration

External Modem Port

iNET radios can be configured to work with the External Modem port on ACE3600 RTUs (see Configurations 1, 2 and 3 above.)

Use the iNET radio programming software to program the AP (Access Point) and then the remote with the following settings.

Note:

- Radio firmware should be 4.4.0 or above.
- IP Address refers to the Ethernet port IP and not the “over the air” IP.

The initial screen is as follows:

```
MDS iNET 900
 Starting Information Screen
-=====================================================================-

      Device Mode:            Access Point

      Device Name:            AP Demo Set I

      Network Name:           Demo Set l

      IP Address:             169.254.0.12

      Device Status:          Operational

      Uptime:                 01 hrs, 51 min

      Firmware Version:       4.4.0

      Hardware Version:       1.0.3

      Serial Number:          1069975


               Press 'G' to go to Main Menu
```

1. Press 'G' and the Main Menu will be displayed.
2. Press 'D' and the Serial Gateway Configuration Menu will be displayed.
3. Press 'D' to enable COM2 (if it is not enabled). Use the SPACE bar to cycle between Enabled and Disabled. COM2 should be Enabled and COM1 Disabled. Press ENTER once Enabled is shown.
4. Press 'E' and the Serial Configuration Wizard will be displayed. This wizard will assist you in the configuration of your available Serial Data Ports.

5. Press 'A' and the IP Protocol selection menu will appear.
6. Select the IP Protocol you would like to use. The following modes are supported:
   - TCP – Cannot be used for ACE3600.
   - UDP – to be used as ACE3600external modem.
   - PPP – to be used for MDLC over IP (Not relevant for External Modem.)

   Press 'B' to select the UDP port.
7. If you selected UDP above, you will be prompted to select the Topology. You have the following choices:
   - Point to Point is used if you have a single AP and a single remote unit.
   - Point to MultiPoint is used if you transmit to a single radio. This radio is the point, and all radios are the multipoint. For example: An FNE is a point, and all other RTUs are multipoint. No RTU to RTU is provided.
   - MultiPoint to MultiPoint works like a real radio where any radio (RTU) can communicate with another.

   Press 'C' (Multipoint to MultiPoint) to enable routing between any RTU to any RTU.
8. Next, set the values for the Multicast IP Address and Multicast Port. These are the addresses used when transmitting and receiving. They should be the same on all radios. Press 'A' and enter “224.254.1.1” for the Multicast IP Address.
9. Press 'B' and enter “30011” for the Multicast Port.
10. Press 'C' to continue the wizard until the final screen, or abort it by pressing 'Q'.
11. When the final wizard screen appears prompting you to “Change values (if necessary) for UDP Data Connection Settings”, do not change any values. Press 'Q' to quit wizard.
12. The COM2 Serial Data Port values will be displayed. Press 'G' and set the appropriate Baud Rate (from 1200 bps to 115200 bps.)
13. The Hardware Configuration values will be displayed. Press 'G' to select the 8N1 hardware configuration for the port.
14. It is recommended to have Hardware Flow Control on the serial port enabled. When prompted, press 'A' to enable Hardware Flow Control.
15. When prompted to select the Serial Packet Mode, press 'A' to use the default value (Seamless Mode.) Press Q to exit wizard.

The settings for the COM2 Serial Data Port should appear as follows:

```
AP Demo Set I
 Serial Configuration Wizard
 -==========================================================================-

   COM2 Serial Data Port

 A) Status                enabled
 B) IP Protocol           UDP Multipoint to Multipoint
 C) Multicast IP Address        224.254.1.1
 D) Multicast Port        30011
 E) Time to Live          1
 F) Packet Redundancy Mode            Single Packet Mode
 G) Data Baud Rate                9600
 H) Configuration         8N1
 I) Flow Control          enabled
 J) Serial Mode           Seamless
 K) Seamless Inter-Frame Delay         4

 X) Commit Changes and Exit Wizard


  These changes will take effect immediately...
    Are you sure (y/n)?
 Select a letter to choose an item, <ESC> for the prev menu, 'Q' to quit wizard
```

16. Press 'X' to save the changes and exit the wizard. When prompted with "These changes will take effect immediately... Are you sure (y/n)?", press 'y' and ENTER. There is no need to power up the iNET radio. Note that these settings are saved and you do not need to reset them when powering up the radio unit again.

17. Press ESC to return to the Main Menu.

18. From the Main Menu, press 'B' to select Network Configuration. This is needed if you want to set an IP connection to the radio unit (recommended). Ethernet port is needed if you are using an IP Interface on RTUs and Ethernet port on IP Gateway (MDLC over IP). In any case, it is recommended that you set it.

19. Next press 'G' for IP Address configuration.

20. In the IP Address Configuration Menu, press 'B' to set the Static IP Address to 169.254.0.12.

21. Next press 'C' to set the Static IP subnet mask to 255.255.0.0. It is recommended that all units having the same AP (Access Point) be on the same subnet mask.

22. Press ESC to return to the Network Configuration Menu.

23. Finally press 'D' and enter the maximum number of remotes. By default this value is 50. If the AP has more than that, you must change the value.

24. Your configuration of the AP is complete. Return to the Starting Information screen (Step 1 above) and repeat all steps with the remote unit. All of the settings/values are the same.

MDLC over IP Port

iNET radios can be configured to work with the MDLC over IP port on ACE3600 RTUs (see Configurations 4-7 above.)

MDLC over IP supports:

- IP Gateway 4.xx configured with MDLC over IP over Ethernet port.
- ACE3600 RTU Ethernet port
- ACE3600 RTU RS232 port configured as MDLC over IP over PPP connected to Standard modem.

When using an RTU with EP Ethernet port, connect the RTU Ethernet port to the iNET Ethernet port. The IP Port should be on the same subnet as the iNET. Its Subnet mask and IP Gateway should be the same. The rest of the configuration should be the same as an MDLC over IP port (i.e. configuring the port and setting the appropriate baud rate and Link ID, and downloading the IP Conversion Table.) The P Conversion Table is needed to communicate with other RTUs connected over PPP or Ethernet.

The rest of the configuration should be the same as an MDLC over IP port (as above). All IP settings are obtained dynamically from the modem when connecting to it. The RTU PPP port should be connected to COM2 on the iNET radio using a computer adapter. The following describes how to configure iNET COM2 modem for PPP.

After configuring the IP Gateway, EPIB for Ethernet, and RTU (for PPP) with MDLC over IP port, they can all communicate on the iNET network as if they all reside on a LAN. All routing between them is done via the iNET network, and if a LAN is involved, using other routers as well. Any RTU can communicate with any other RTU or IP Gateway. A single Link ID should be set for all RTUs/ IP Gateways on these ports.

Note however, that if the MDS radio was connected via External Modem port (serial), or via a Terminal Server (e.g. Equinox) over serial port, it is a completely different MDLC link/protocol. A different Link ID should be set in the RTU/IP Gateway when using this configuration. If both coexist on the same iNET network, each should have its own Link ID with MDLC network configuration downloaded to all units.

Use the iNET radio programming software to program the AP (Access Point) and then the remote with the following settings.

Note:

- Radio firmware should be 4.4.0 or above.
- IP Address refers to the Ethernet port IP and not the "over the air" IP.

The following shows Access point configuration for MDLC over IP but it is exactly the same for Remote.

The initial screen is as follows:

```
MDS iNET 900
 Starting Information Screen
 -===================================================================-

       Device Mode:         Access Point

       Device Name:         AP Demo Set I

       Network Name:        Demo Set l

       IP Address:          169.254.0.12

       Device Status:       Operational

       Uptime:              01 hrs, 51 min

       Firmware Version:    4.4.0

       Hardware Version:    1.0.3

       Serial Number:       1069975

               Press 'G' to go to Main Menu
```

1. Press 'G' and the Main Menu will be displayed.
2. Press 'B' and the Network Configuration Menu will be displayed.
3. Press 'G' for IP Address configuration.
4. In the IP Address Configuration Menu, press 'B' to set the Static IP Address to 169.254.0.12.
5. Next press 'C' to set the Static IP subnet mask to 255.255.0.0. It is recommended that all units having the same AP (Access Point) be on the same subnet mask.

   Note that the Static (sub)Net Mask and Static IP Gateway addresses should be the same as those of the IP Gateway and EPIB. Their IP Address should be on the same subnet. For example 169.254.0.100 for an IP Gateway address of 169.254.0.012 is suitable.

   Also note that when using PPP it is recommended to have the IP Address of PPP on the same subnet, for example 169.254.0.13. See Configuring for PPP below.

6. Press 'E' to commit changes. Press ESC to return to the Network Configuration Menu.
7. Finally press 'D' and enter the maximum number of remotes. By default this value is 50. If the AP has more than that, you must change the value.

8. Your configuration of the AP is complete. Return to the Starting Information screen (Step 1 above) and repeat all steps with the remote unit. All of the settings/values are the same.

Configuring for PPP

9. From the Main Menu, press 'D' and the Serial Gateway Configuration Menu will be displayed.

10. Press 'D' to enable COM2 (if not enabled). SPACE to cycle between Enabled and Disabled. COM2 should be Enabled and COM1 Disabled. Press ENTER once Enabled is shown.

11. Press 'E' and the Serial Configuration Wizard will be displayed. This wizard will assist you in the configuration of your available Serial Data Ports.

12. Press 'A' to begin the Wizard and the IP Protocol selection menu will appear.

13. Select the IP Protocol you would like to use. The following modes are supported:

    - TCP - to be used as a Terminal Server. (IP Gateway does not support this option.)
    - UDP - to be used as External Modem.
    - PPP - to be used as PPP port (same as Ethernet).

    Press 'C' to select PPP.

14. The wizard will prompt you to change the value of the IP Address. Press 'A' and enter the Remote IP Address. This is the address that is uniquely assigned to the RTU. It should be different from the other addresses used in the iNET network and in the LAN (if connected to LAN).

    A good scheme is to add 1 to the Static IP Address set in the Network Configuration screen above. For example, if the address 169.254.0.12 was assigned to the iNET Ethernet port, the PPP would be assigned 169.254.0.13. Both addresses reside in the same subnet 255.255.0.0 as was set in the Network Configuration. When using a PPP port, two IP addresses are set for iNET, one for the Ethernet port, and another (on the same subnet) for PPP. It is recommended to make those addresses consecutive where possible.

15. Press 'B' and the Data Baud Rate screen is displayed.

16. Select the baud rate according to the RTU, e.g. 'D' for 9600.

17. Next press 'G' to select the 8N1 hardware configuration.

18. It is recommended to have Hardware Flow Control on the serial port enabled. When prompted, press 'A' to enable Hardware Flow Control.

19. When prompted to select the Serial Packet Mode, press 'A' to use the default value (Seamless Mode.)

The settings for the COM2 Serial Data Port should appear as follows:

```
Serial Configuration Wizard
-==================================================================-
  COM2 Serial Data Port

A) Status                          enabled
B) IP Protocol                     Point to Point Protocol (PPP)
C) Device IP Address                       169.254.0.13
D) Data Baud Rate                          9600
E) Configuration                           8N1
F) Flow Control                    enabled
G) Serial Mode                     Custom
H) Custom Inter-Frame Delay                4
I) Custom Data Buffer Size                 64






Select a letter to choose item, <ESC> for the prev menu, 'Q' to quit wizard
```

20. Press 'X' to save the changes and exit the wizard. There is no need to power up the iNET radio. Note that these settings are saved and you do not need to reset them when powering up the radio unit again.

21. From the Serial Gateway Configuration, press ESC to return to the Main Menu.

Your configuration of the PPP is complete.

RTU Configuration

The RTU port is configured using the ACE3600 STS.

Site Configuration

Procedure 21-31 How to Configure the ACE3600 Port for the iNET 900 Radio

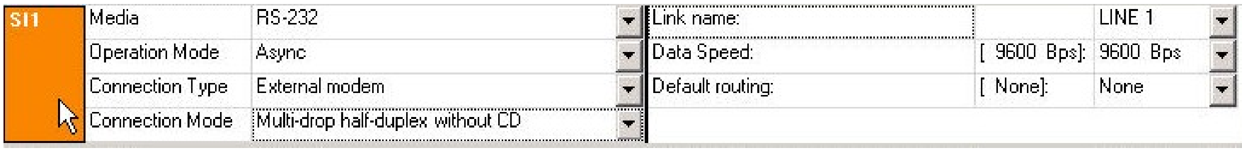
In the ACE3600 STS click on the desired site, and open the site view.

2. In the Port Tab, click on the on-board or plug-in port through which the RTU will communicate with the iNET radio.

3. Confirm that the port parameters and data speed are as shown in the screen below.
   Note: If the baud rate of the radio is not the default value (9600), the baud rate of the port should be configured accordingly.

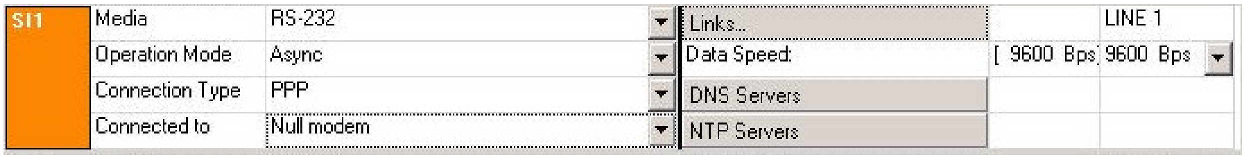
4. Define desired links.

5. Save the changes.



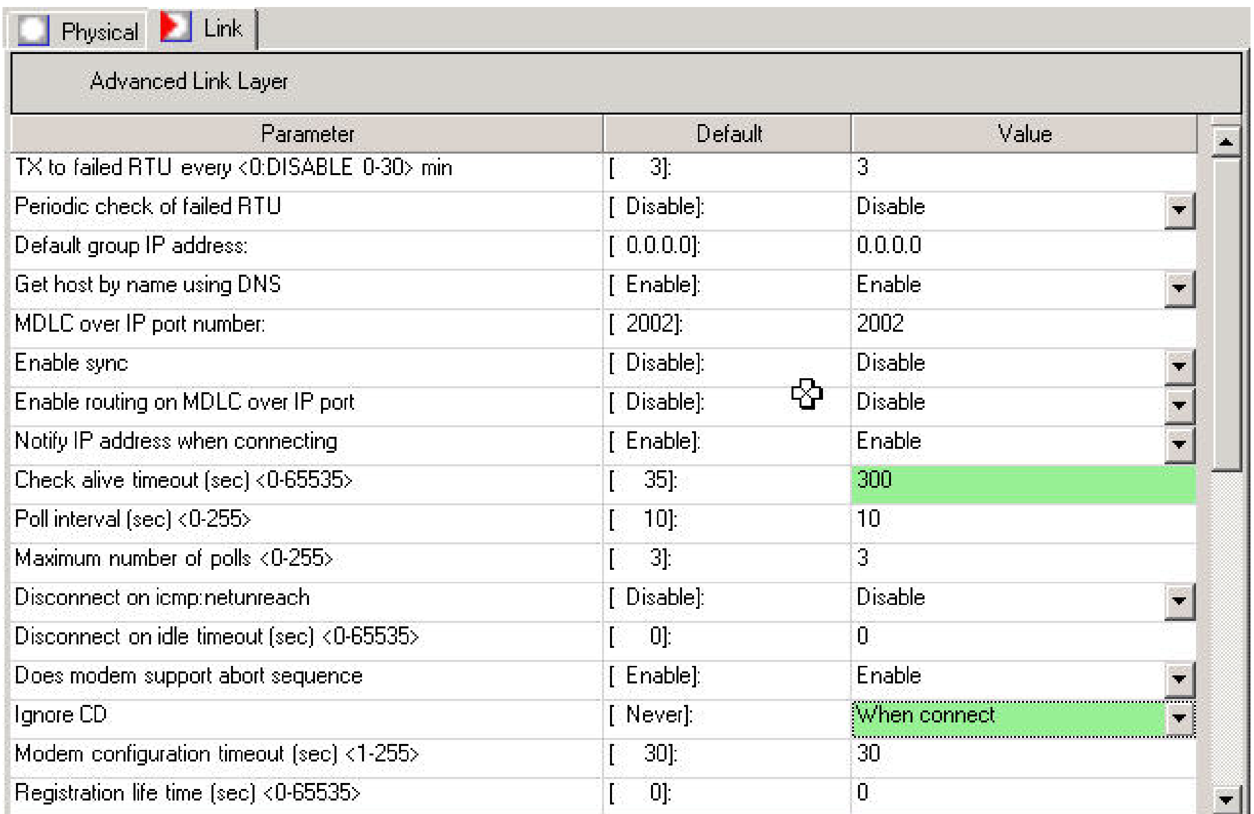
SI1	Media	RS-232	Link name:		LINE 1
	Operation Mode	Async	Data Speed:	[9600 Bps]:	9600 Bps
	Connection Type	External modem	Default routing:	[None]:	None
	Connection Mode	Multi-drop half-duplex without CD			

Figure 21-54 RTU Site Configuration for iNET Radio– External Modem Port Port Type Parameters



SI1	Media	RS-232	Links...		LINE 1
	Operation Mode	Async	Data Speed:	[9600 Bps]	9600 Bps
	Connection Type	PPP	DNS Servers		
	Connected to	Null modem	NTP Servers		

Figure 21-55 RTU Site Configuration for iNET Radio– MDLC over IP Port Port Type Parameters



Physical | Link

Advanced Link Layer

Parameter	Default	Value
TX to failed RTU every <0:DISABLE 0-30> min	[3]:	3
Periodic check of failed RTU	[Disable]:	Disable
Default group IP address:	[0.0.0.0]:	0.0.0.0
Get host by name using DNS	[Enable]:	Enable
MDLC over IP port number:	[2002]:	2002
Enable sync	[Disable]:	Disable
Enable routing on MDLC over IP port	[Disable]:	Disable
Notify IP address when connecting	[Enable]:	Enable
Check alive timeout (sec) <0-65535>	[35]:	300
Poll interval (sec) <0-255>	[10]:	10
Maximum number of polls <0-255>	[3]:	3
Disconnect on icmp:netunreach	[Disable]:	Disable
Disconnect on idle timeout (sec) <0-65535>	[0]:	0
Does modem support abort sequence	[Enable]:	Enable
Ignore CD	[Never]:	When connect
Modem configuration timeout (sec) <1-255>	[30]:	30
Registration life time (sec) <0-65535>	[0]:	0

Figure 21-56 RTU Site Configuration for iNET Radio– MDLC over IP Port Advanced Link Layer Parameters

IP Conversion Table

Prepare an IP Conversion Table and download it to the RTU. The IP Address of the RTU is the one assigned by the iNET 900 to the RTU, referred to as Remote IP Address in Configuring for PPP above. This IP address can be retrieved using the ACE3600 STS SW Diagnostics & Loggers utility in Device LIN1L, level 0.

Verify that the connection succeeded using the SW Diagnostics & Loggers utility. In Device LIN1L, level 101, make sure that the "State of configuration task" field is set to "connected and registered". This may take between 30-60 seconds.

MDS Radio Installation Kit

The MDS installation kit (V152AK/FLN3853A) enables the user to install the 9810 Spread Spectrum, 9710A- 900 MHz and 4710 UHF Transceiver radio modems in ACE3600 Remote Terminal Units (RTU). The kit includes a bracket and cables.

Installation

The MDS radio can be mounted on the ACE3600 RTU as follows:

Procedure 21-32 How to Install the MDS 900 Radio on the Metal Chassis

1. Connect the radio to the bracket provided in the Hardware Kit (#0789971V39 from FHN7066A) using the four screws, supplied with the bracket. (See Figure 21-57 below.)

Figure 21-57 MDS Radio Mounted on Metal Bracket - Front and Rear View

2. Connect the communication cable (FKN8513A) to the 25-pin connector on the side of the radio and tighten the screws.

3. Insert the DC power cable (FKN8510A) connector into the DC power connector on the radio.
4. If the RTU is to be installed inside an enclosure, screw the antenna cable (FKN8509A) into the antenna connector on the radio. Otherwise, an external antenna can be connected directly to the antenna connector on the radio.
5. Mount the bracket (#0789971V39 from FHN7066A) on the RTU chassis above the I/O modules, using the four built-in screws. (See Figure 21-58 below.)
6. Route the antenna cable (FKN8509A) cable through the small wire clamps along the left side edge of the RTU chassis, according to the placement of the radio on the chassis, as in Figure 21-58 and Figure 21-59.
7. Unscrew the nut and locking washer from the N-type connector at the other end of the antenna cable. Thread the end of the cable through the opening on the bottom of the enclosure and screw on the nut and locking washer from outside the enclosure.
8. Connect the other end of the DC power cable (FKN8510A) to the AUX1A/B connector on the RTU's power supply module.
9. Connect the other end of the communication cable (FKN8513A) to the ACE3600 CPU module port configured for the radio. See RTU Configuration below.
10. Connect the antenna cable to an external antenna.

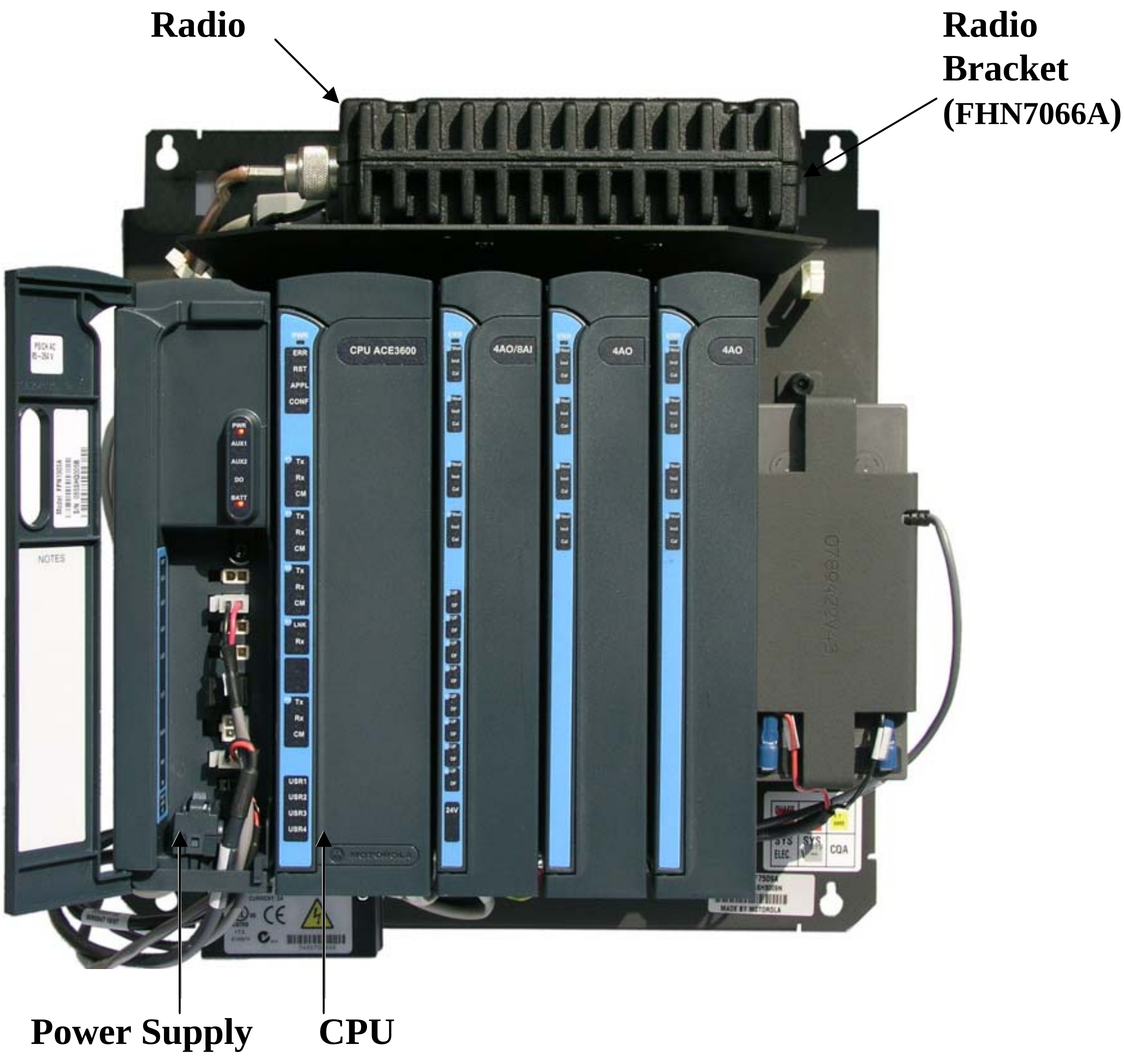


Figure 21-58 MDS Radio Modem Installed on ACE3600 Chassis

Figure 21-59 MDS Radio Modem Installed on ACE3600 Chassis – Cable Connections

RTU Configuration

The RTU port is configured using the ACE3600 STS as follows:

Procedure 21-33 How to Configure the ACE3600 Port for the MDS Radio

1. In the ACE3600 STS click on the desired site, and open the site view.

2. In the Port Tab, click on the on-board or plug-in port through which the RTU will communicate with the MDS radio.

3. Confirm that the port parameters and data speed are as shown in the relevant screen below. Note: If the baud rate of the radio is not the default value (9600), the baud rate of the port should be configured accordingly.

4. Define desired links.

5. Save the changes.

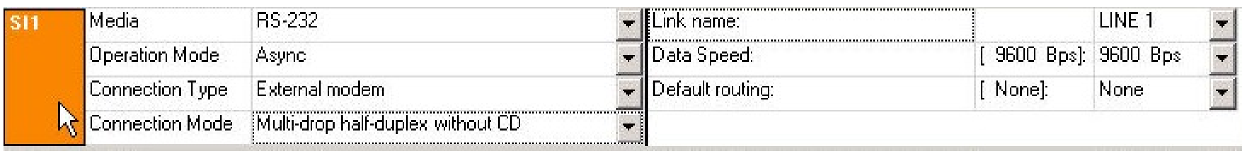


Figure 21-60 RTU Site Configuration for MDS 9810 Spread Spectrum/4710 UHF Transceiver Radio– Port Type Parameters

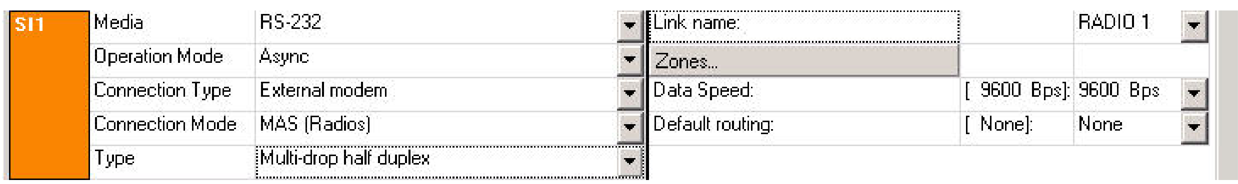


Figure 21-61 RTU Site Configuration for MDS 9710A- 900 MHz Radio– Port Type Parameters

MTM800 Radio Installation Kit

The MTM800 Installation Kit for ACE3600 (FLN4109A) enables the user to install the MTM800 mobile radio in ACE3600 Remote Terminal Units (RTU). Each kit includes a bracket, adapter, and cables.

Installation

The MTM800 can be mounted on the ACE3600 RTU as follows:

Procedure 21-34 How to Install the MTM800 Radio on the Metal Chassis

1. If you choose to attach the MTM800 radio to a plug-in port, attach the radio plug-in port from the installation kit (FLN4109A) to the desired opening on the ACE3600 CPU module. For instructions on attaching plug-in ports, see Connecting Plug-In Ports to the CPU Module in the CPU Module chapter above.

2. Connect the 20-pin connector radio signal and power cable (FKN8517A) to the accessory connector on the radio. (See Figure 21-62 and Figure 21-63.)

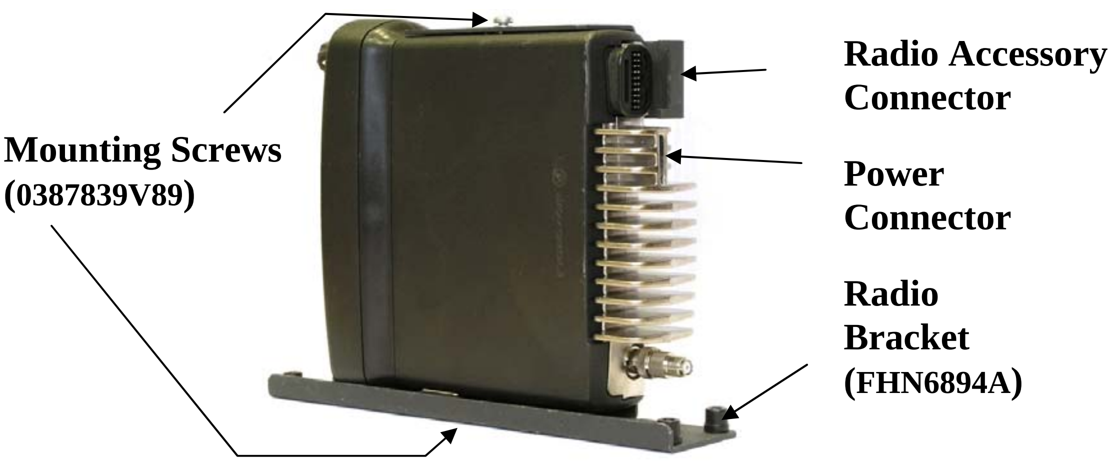


Figure 21-62 MTM800 Radio and Metal Bracket

3. Connect the end of the power cable (FKN8517A) to the radio's power connector. (See Figure 21-62 and Figure 21-63.) Connect the other end of the power cable to the AUX1A or AUX1B connector on the ACE3600 RTU Power Supply unit. (See Figure 21-64.)

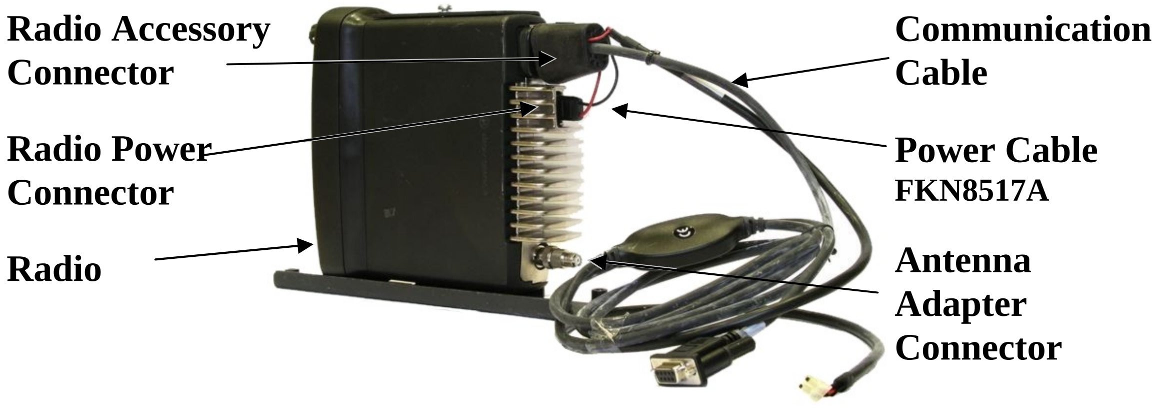


Figure 21-63 MTM800 Radio Cable Connections

4. Connect the communication cable (FKN8516A) to the end of the power and signal cable using the attached screws (FKN8517A). (See Figure 21-63.) Place one Fair-Rite soft ferrite (#7683477X01 from the supplied ferrite kit FHN7007A) on the cable near the bottom of the CPU door, loop the cable one turn around it, and clamp the ferrite on the cable. Connect the other end of the communication cable to the plug-in port of the ACE3600 CPU.

5. Mount the MTM800 radio onto the metal bracket (#0789422V45) using the two supplied radio mounting screws from kit FHN6894A, # 0387839V89 on the top and bottom of the radio. (See Figure 21-62, Figure 21-63 and Figure 21-64.)

6. Connect the antenna cable (FKN8430A/FKN8429A[*]) to the antenna adapter connector on the radio and to the opening on the bottom of the ACE3600 housing using the appropriate bushing. (See Figure 21-64.) Mount the complex (bracket and radio) on the RTU chassis above the CPU and I/O modules, using the four built-in screws. (See Figure 21-64.)

[*] Antenna Cable provided may be either FKN8429A (with UHF connector plus antenna adapter 5871143Y01) or FKN8430A.

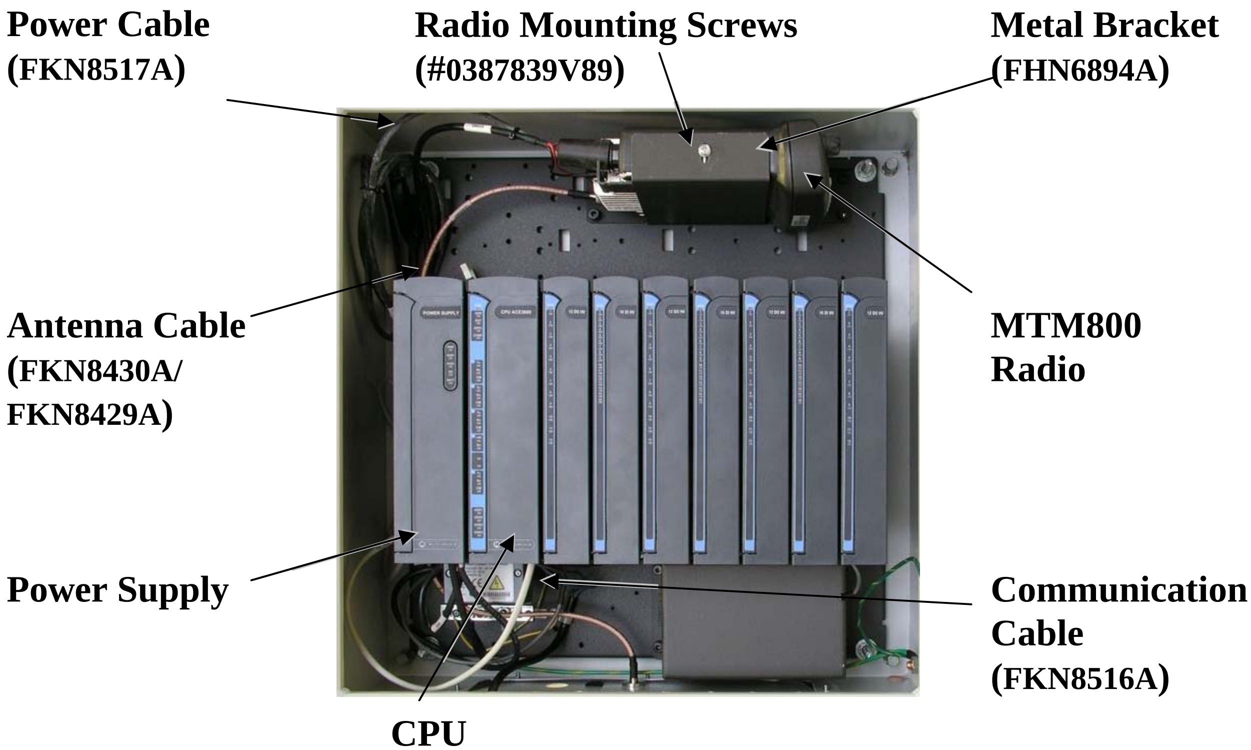


Figure 21-64 MTM800 Radio Installed on ACE3600 Chassis

RTU Port Configuration for the MTM800 Radio

To enable MDLC communication using MTM800 radios (for packet data only), use the ACE3600 STS site configuration utility to configure the ACE3600 RTU plug-in port connected to the radio.

The figure below shows the port configuration and advanced parameter configuration. Although this shows Port PI1, the same values can be applied to other serial or plug-in ports, where relevant.

Port Type

Procedure 21-35 How to Configure the ACE3600 Port for the MTM800 Radio

1. In the ACE3600 STS, click on the desired site, and open the site view.
2. In the Port Tab, click on the on-board or plug-in port through which the RTU will communicate with the MTM800 radio.
3. Confirm that the port parameters and data speed are as shown in the screen below.

PI1	Media	RS-232	Links...		LINE 2
	Operation Mode	Async	Data speed:	[9600 Bps	9600 Bps
	Connection Type	PPP	DNS Servers		
	Connected to	TETRA	NTP Servers		
			Protocols...		

4. Define desired links.
5. If you plan to synchronize the RTU time using an NTP server, use a DNS server, or use third party protocols, specify these with the relevant information for your system.
6. Save the changes.

Advanced Parameter Configuration

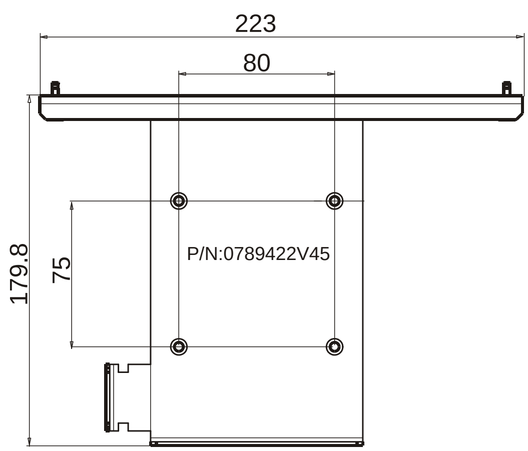
The STS provides default settings for advanced port parameters for use with the MTM800. These settings should be used.

Programming the MTM800 Radio using CPS

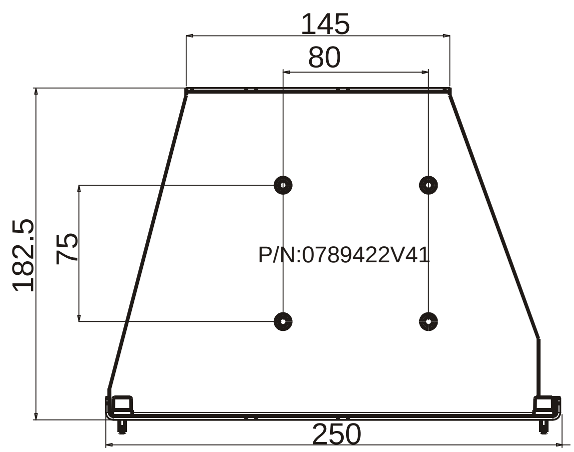
Before connecting a MTM800 radio to an ACE3600 RTU, the radio should be programmed as necessary for packet data. For this purpose, use the CPS which can be ordered with the radio or bring the radio to the Motorola Service Center.

Mounting the ACE3600 Radios on a Wall

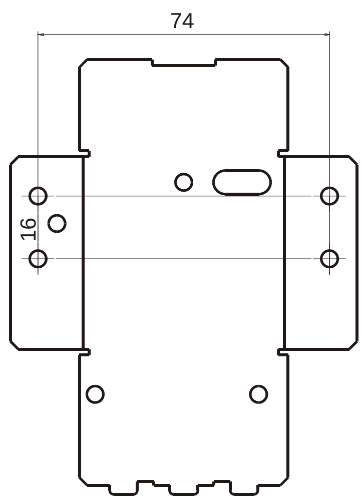
ACE3600 radios can be mounted on a wall near the ACE3600 frame/housing, using a special metal bracket. This bracket is part of the specific radio installation kit and must be ordered.



CM/EM/GM/CDM750 Bracket



XTL5000/XTL2500 Bracket



GP/HT/PRO Bracket

Figure 21-65 Radio Wall Mount Brackets

Procedure 21-36 How to Mount a Radio on a Wall

The following installation procedure should be followed to install radios on a wall near the ACE36000 frame. A special wall mount bracket is provided with the radio installation kit, which can be ordered separately from the frame. Allow extra space around the bracket for the radio and wires.

1. Drill four holes in the wall at the horizontal and vertical distances (in mm) shown in Figure 21-65 for the desired radio wall mount bracket, at the desired angle/orientation.

2. Place the bracket on the wall, lining up the bracket holes with the drilled holes.

3. Insert four M3 Phillips 10mm screws (not supplied) into the holes and tighten with a screwdriver to secure the bracket firmly against the wall.

4. Attach the radio to the bracket using the supplied screws.

RS485 CONNECTION BOX

General Description

The RS485 Connection Box (V186AD/FLN3641A) provides an interface to up to seven RS485 connections. (See Figure 22-1.)

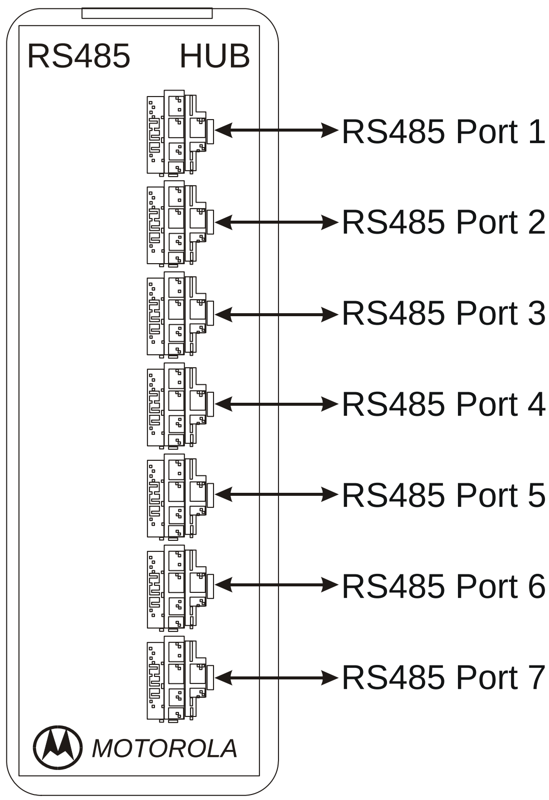


Figure 22-1 RS485 Connection Box – Front Panel

Installation

The RS485 Connection Box can be easily installed on the RTU chassis.

Mounting the RS485 Connection Box on the RTU Chassis

1) To connect the plastic accessory box interface to the metal chassis, place the box on the metal plate and click the two pegs on the back of the accessory box into the desired holes on the metal chassis.

Wire Connections

1) To interface to an RTU, connect the communication cable (FKN8427A) between the connection box input port and the ACE3600 RS485 port. *

2) To interface to an external device, connect the communication cable (FKN8427A) between the connection box port and an external RS485 modem with an RJ45 connector.

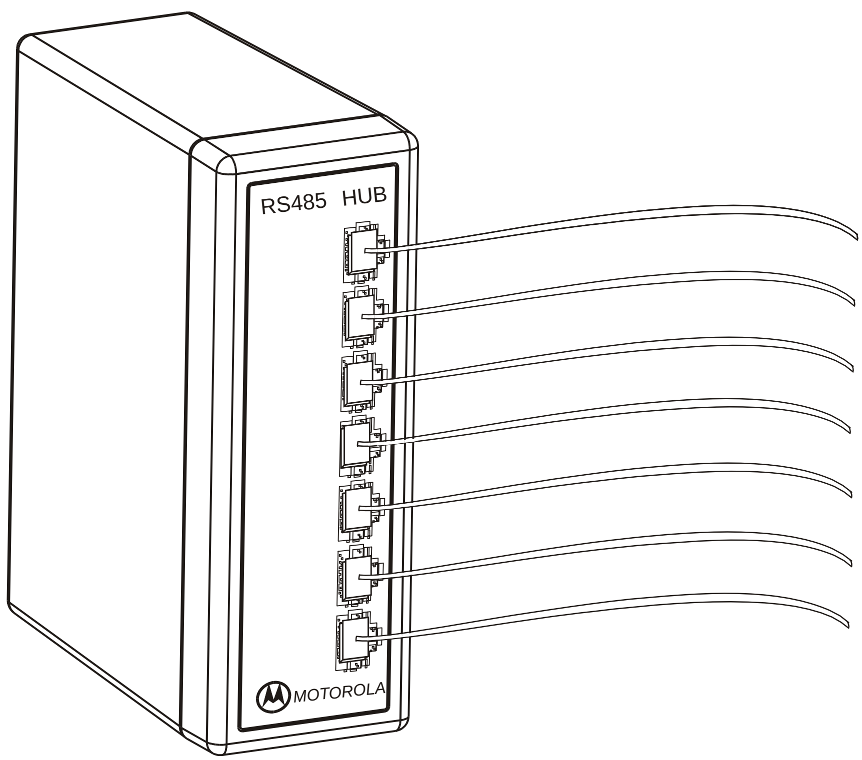


Figure 220-2 RS485 Connection Box – Wire Connections

* For connection to MOSCAD port, use FKN8527A. See Appendix C.

AUDIO CONTROL AND TONE (ACT) MODULE

Introduction

The Audio Control and Tone (ACT) module (V155AE/FLN3851A) serves as a player of recorded voice and alarm sounds in ACE3600 based alert systems. The ACT module also routes low-level sound signals to high-level amplifiers. The high-level sound can be directed to specified alert speakers in a set of six speakers, mounted in different locations.

The ACT module contains an internal audio memory that allows custom tones or audio sounds to be recorded and stored in the ACT module. Recording of audio may be done directly from a low-level output source (tape recorder, laptop or radio output).

Front Panel Description

The ACT module is enclosed in a compact plastic accessory box. See the ACT module below.

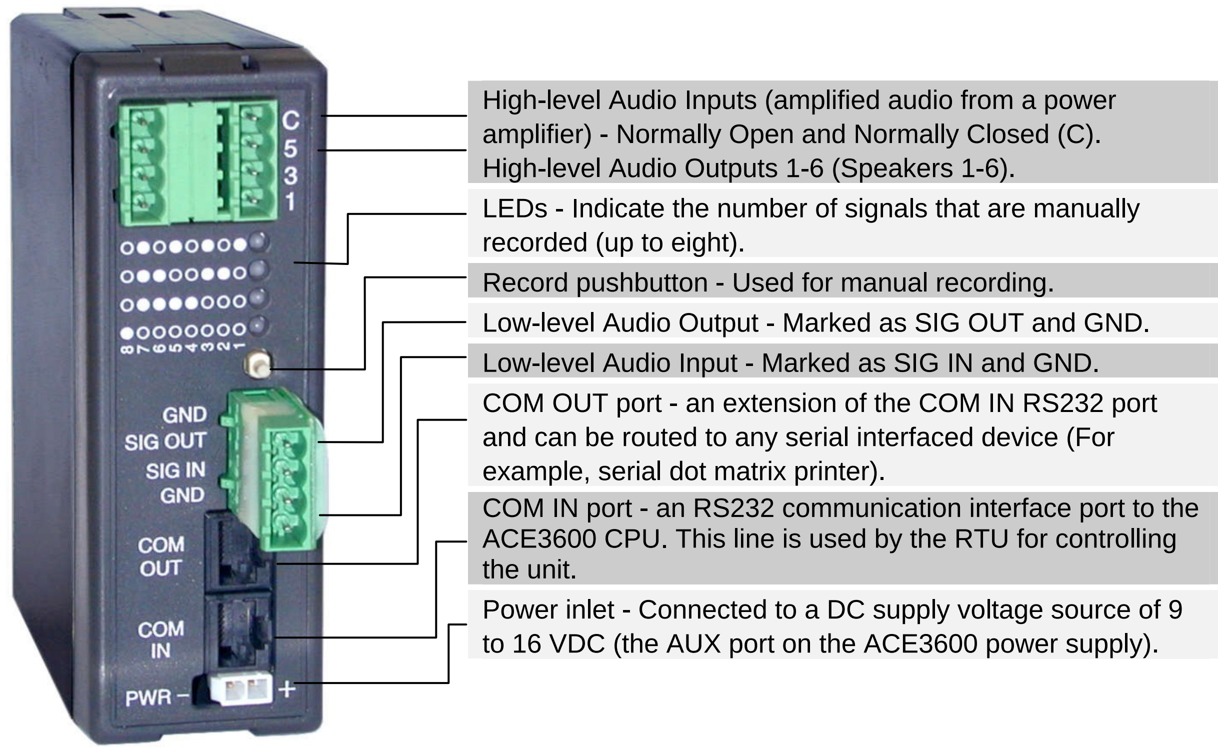


Figure 23-1 ACT Module – Front Panel

ACT Module Features

The ACT module features are described below:

- Controlled by the RTU via an RS232 serial port using a simple instruction set.
- Digitally records audio signals (alarm tones, voice announcements, etc).
- Plays stored audio signal.
- Interface to an external low-level audio signal source (microphone, radio audio out, etc.).
- Interface to input of one audio amplifier and up to two outputs of audio amplifiers.
- Connects to up to six speakers.
- Selective output to any combination of six speakers.
- Routes the audio signals from the amplifier(s) output to selected speakers.
- Routes data coming from the RTU to a serial printer to allow printing of information by alternative use of the RTU serial port.

The ACT module block diagram is shown below:

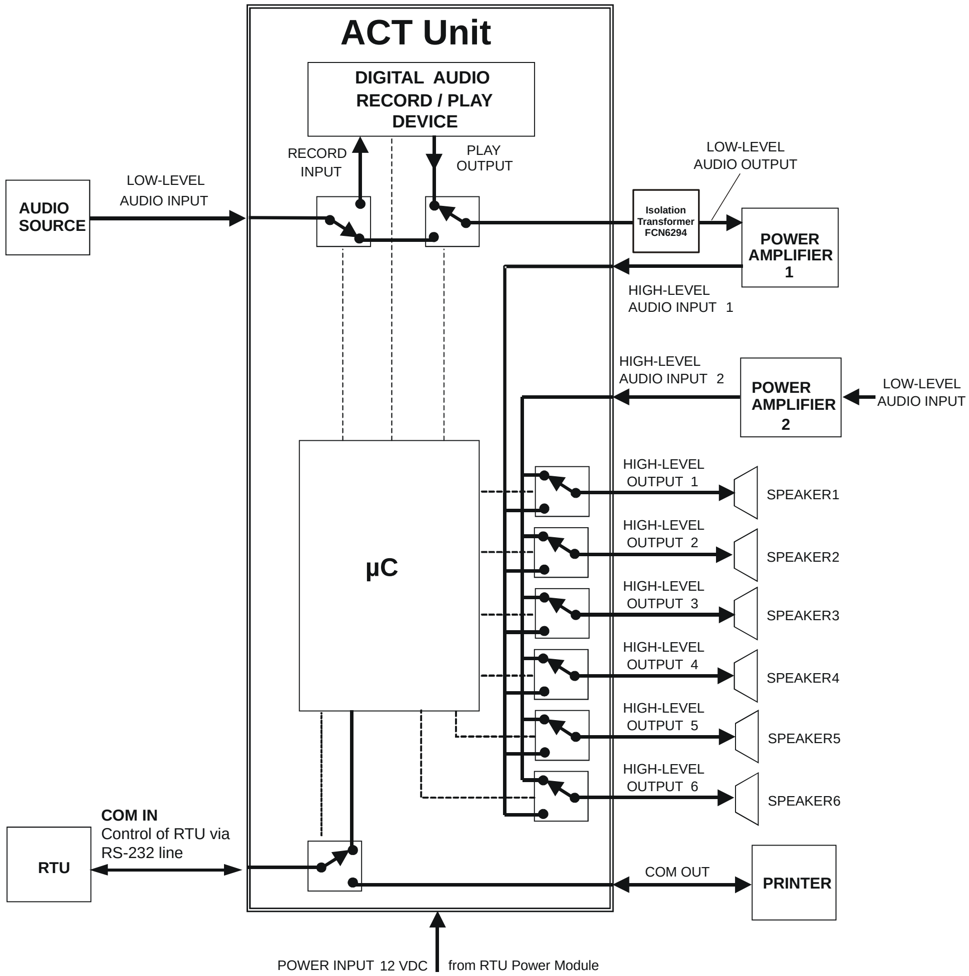


Figure 23-2 ACT Module – Simplified Block Diagram

Audio Handling Capabilities

The ACT module has built-in hardware which records and stores audio signals by digitizing the signal from an audio source connected directly to the module's low-level audio input. The module can play these pre-recorded audio signals once or repeatedly.

To facilitate the recording process, audio signals may be formed or saved in "WAV" file format on a PC (or on any other audio format provided it can be played by a PC) and then downloaded to the module through the PC audio out.

The module's total recording capacity is 240 seconds. As default, the recording space is divided into eight "cells" (each of which holds up to 30 seconds). The number of cells is configurable and can be set to 1, 2, 4, 8, 16, 30 and 60.

NOTE: Recording will automatically terminate 2 seconds after the module detects silence. Recording will also be stopped when the "cell" has run out of recording capacity.

The module's low-level audio input also enables the connection of an external low-level audio source (such as a radio audio output) for direct routing to an audio amplifier. Thus the audio routed to this output can be either a pre-recorded audio signal or an external source, connected to the low-level audio input.

Two high-level audio inputs are used to route amplified audio signals into the module. The ACT module has six high-level audio outputs that can be routed to selected speakers.

Interface to the RTU

The ACT module interfaces to the RTU via an RS232 port, marked as COM IN. The communication with the RTU is based on an 8-bit code protocol.

The ACT module also enables the RTU to have more than one use for its RS232 port. The application on board the RTU may select its serial port connected to COM IN to control the ACT module or to send data to COM OUT. This is very useful for connecting a dot matrix printer to the RTU without requiring an additional serial port which could necessitate the another CPU.

The destination of the serial data sent to the COM IN port is selected via the following mechanism:

- Set DTR signal "Off" – Data is routed to COM OUT.
- Set DTR signal "On" – Data protocol controlling the ACT.

The ACT module operates on 9 to 16 VDC, usually supplied by the RTU's auxiliary power supply.

An RTU application program controls the ACT module via a user port using an 8-bit instruction set.

The ACT module returns simple 8-bit codes as a response to instructions.

The instruction set is comprised of the following set of operations:

- Play
- Repeat Play # times
- Stop - Play
- Enable low-level Audio Output
- Disable low-level Audio Output
- Configure the number of recorded signals (cells)
- Record
- Report Status
- Connect/Disconnect Speakers

For the ACT module instruction set, see *ACT Instruction Set* below.

Installation and Wiring

The ACT can be installed in various locations on the RTU chassis (mounted on holes prepared for installation).

Note: Connect the ACT to the High Power Audio Amplifier only via the Isolation Board - FCN6294A (connected to the SIG IN/SIG OUT connector).

Procedure 23-1 How to Install the ACT Module

1) Place the ACT module on the metal plate and click the two pegs on the back of the accessory box into the desired holes on the metal chassis.

2) Connect one end of the power cable (FKN8433A) to the PWR connector on the ACT module. Connect the other end of the cable to the one of the AUX connectors (configured to 12V) on the ACE3600 power supply module.

3) Connect one end of the communication cable (FKN8427A) to the COM IN port on the ACT module. Connect the other end of the cable to the RS232 port on the ACE3600 CPU.

4) To use high-level audio speakers, connect up to six speakers to the High-Level Audio Out (1-6) relays on the top of the ACT module front panel. See Figure 23-3 below.

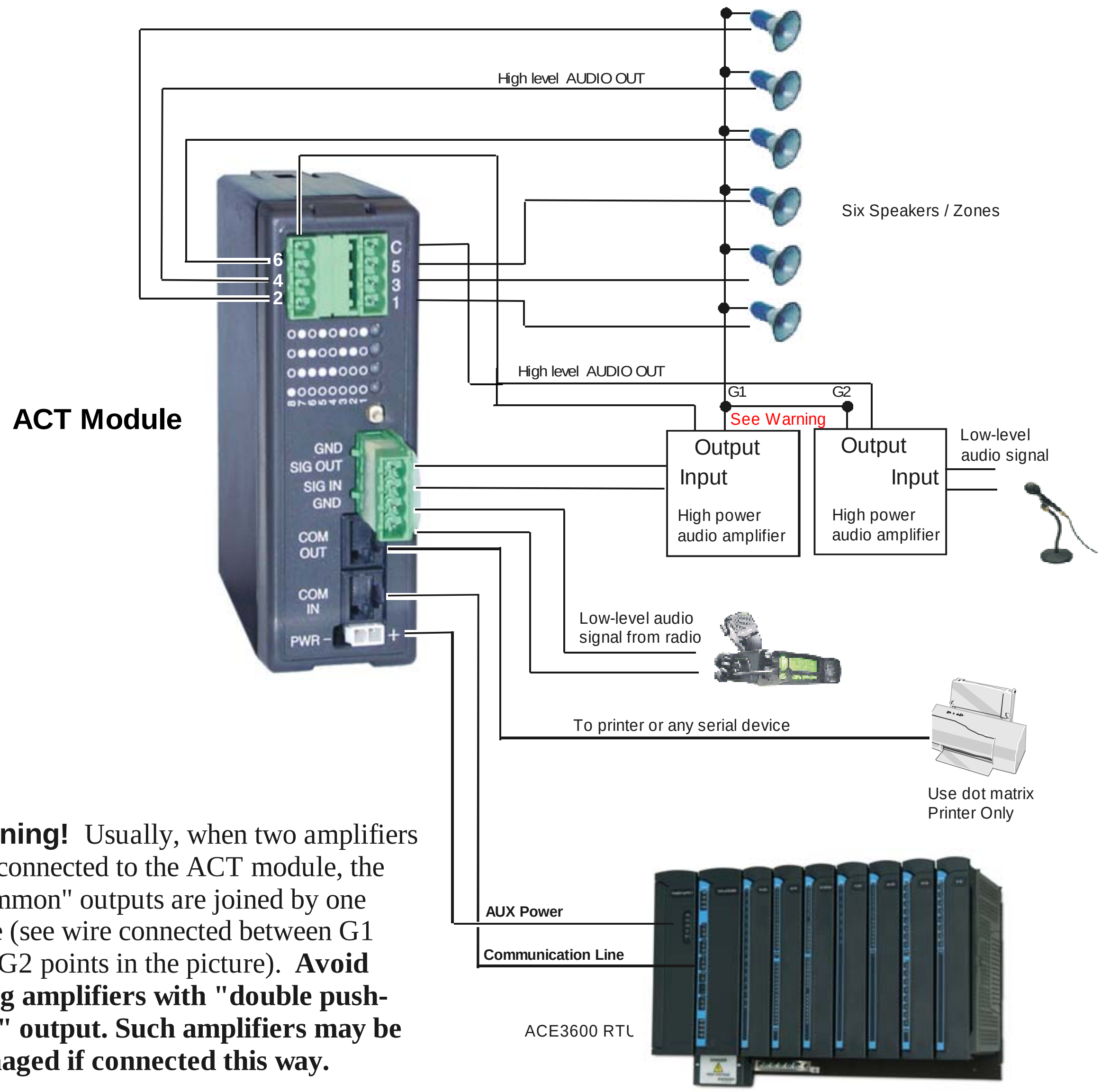
5) To enable playing prerecorded tones, connect the input of the first high power audio amplifier to the SIG OUT/GND connectors, using the Isolation Board (FCN6294A). Connect the output of the amplifier to the Normally Open connector on the top left corner of the ACT module front panel. See Figure 23-3 below.

6) To enable radio voice channel audio (low level signal), connect the external speaker of the voice radio to the SIG IN/GND connectors, using a simple wire cable (can be shielded). See Figure 23-3 below.

7) To add a second high power audio amplifier for local microphone, connect the output of the second amplifier Normally Closed (C) connector on the top of the ACT module front panel. Also connect the output of the second amplifier to the output of the first amplifier. See the warning in Figure 23-3 below.

8) To use a local microphone (low-level audio signal), connect the microphone to the second amplifier.

9) To attach a dot matrix printer or other serial device, connect the device to the COM OUT connector on the ACT module using a data cable (with connector adaptors as necessary.) See Figure 23-3 below.



Warning! Usually, when two amplifiers are connected to the ACT module, the "common" outputs are joined by one wire (see wire connected between G1 and G2 points in the picture). **Avoid using amplifiers with "double push-pull" output. Such amplifiers may be damaged if connected this way.**

Figure 23-3 ACT Module – Wiring Diagram

Table 23-1 ACT Module Communication Ports Connection Chart

COM IN		COM OUT
RxD - In	1	TxD
TxD - Out	2	RxD
DTR - Out	3	CTS
GND	4	GND
RTS - Out	5	CD

CD - In	6	RTS
Not Used	7	Not Used
CTS - In	8	DTR

RTU Port Configuration

Before using the ACT module with the RTU, configure the communication port to which the ACT module is connected.

Procedure 23-2 How to Configure the ACE3600 Port for the ACT Module

1) In the ACE3600 STS click on the desired site, and open the site view.
2) In the Port Tab, click on the on-board or plug-in port through which the RTU will communicate with the ACT Module.
3) Set Media to RS-232, Operation Mode to Async, Connection Type to User Port (Ladder Controlled).
4) Save the changes.

Generally no other changes are required to Advanced Physical or Link Layer parameters. For information on the RTU port parameters, see Appendix A: Site Configuration Parameters of the ACE3600 STS User Guide.

Controlling the Module

The RTU (or PC) is interfaced to the ACT via the RS232 port. The communication parameters of the RTU (or PC) port must be set to: 9600 BPS, 1 stop bit, no parity.

The ACT is operated using a simple instruction set. Each instruction must be sent twice. If the second instruction sent does not correspond to the first, that instruction is rejected. When the ACT recognizes a valid instruction, it echoes an acknowledgement. While the module is playing a stored audio signal, the instructions should be sent only once.

ACT Instruction Set

Instruction	**Code**	**Description**
Play Signal #	"01XXXXXX" (XXXXXX=1 - 60)	Plays recorded audio signal number #. The recorded audio is played into the low-level Output. The low-level Output is disabled. *Example: Play signal 6 = "01000110"*
Record Signal #	10XXXXXX (XXXXXX=1-60)	Records audio signal number #. *Example: Record signal 6 = "10000110"*
Connect/Disconnect Speakers	$11X_5X_4X_3X_2X_1X_0$ X_n= Speaker n (n=0-5) 0= disconnect 1= connect	Connects or disconnects speakers.
Repeat the Played Signal # times	001XXXXX XXXXX=1-31	Repeats playing the audio signal # times. Note: *This command can be instructed and performed only while the unit plays a signal*. *Example: Repeat playing the played signal 4 times = "00100100"*
Stop Play	"00011111"	Stops the played signal.
Enable Low-level Audio Output	"00100000"	Low-level Audio Input is routed to Low- Audio Output
Disable Low-level Audio Output	"00000000"	Low-level Audio Output is disabled (no audio is routed to the output). Played signal is stopped.
Configure the number of recorded signals	"000XXXXX" XXXXX=1,2,4,8,15, 30 N=2*(XXXXX)	Configures the number of different signals that can be recorded to n= 2, 4, 8, 16, 30, 60 *Example: Set to 16 signals = "00001000"*
One signal	"00000011"	Configures the number of recorded signals to only one.
Report Status	"01000000"	Use this command to interrogate the ACT. The ACT then returns the following 4 byte sequence with the

		module status: Byte 1: Instruction Echo (“01000000”) Byte 2: Bit 0-5 = Speaker status (0=disconnect) Bit 6 = Play status (1 = play) Bit 7 = Low-level Audio Output status (1= Low-level Input routed to Low-level Out) Byte 3: Possible number of recorded signals Byte 4: The number of recorded audio signal that is currently playing (will be reported only when a signal is played.)

Response to Instructions

The ACT acknowledgements are the 8-bit codes described below:

Response	Code	Description
Record completed	“01111110”	Recording has been completed.
Play started	“10000000”	Signal is currently being played.
Play completed	“01111101”	Signal play has been completed.
Instruction inconsistency	“01111111”	Instruction was not the same as the first one (when not playing); the instruction is not performed.
Instruction time out	”01000000”	Instruction received only once, (when not playing); the instruction is not performed.

Recording Audio Signals

Manual recording enables the recording of up to eight audio signals using the pushbutton (PB) and LEDs on the ACT unit front panel. Follow the steps below to record audio from PC/Laptop/Recorder:

Procedure 23-3 How to Manually Record Audio Signals

1) Connect the "Speaker Out” of the PC/Laptop/Recorder to the "Audio In” port (Use Mono adapter if needed).

2) Pause the audio and tune the volume to approximately ¾ of full scale.

3) Press the PB for more than two seconds; all four LEDs will light up.

4) Press the PB to select the audio cell (from a selection of eight) to which you want to record. (The audio signal number is displayed as a binary number represented by four LEDs).

5) Start playing the audio. The unit will identify the input as audio and start recording. The LEDs will start to blink and will stop when audio input ceases (or when the maximum recording time has elapsed).

6) Repeat steps 4 and 5 to record additional audio signals (up to eight).

7) When recording is completed, all the LEDs will turn off.

ACT Module* Specifications

General	
Operation Voltage	9 to 16VDC
Power Consumption	Refer to Appendix D: ACE3600 Maximum Power Ratings.
Dimensions (H x W x L)	25mm x 95mm x 115mm (1” x 3.6” x 4.5”)
Operating Temperature	-30º to +60º C (-22º to +140ºF)
Relative Humidity	0-95% @ 50° C without condensation
User Connection	
Power connector	Molex 2 pin with polarity
COM IN RS232	Phone 8-pin
COM OUT RS232	Phone 8-pin
Low-level Audio In/Out	4 screw TB connector
High-level In/Out	8 screw TB
Audio	
Low-level Audio Input	0.8 to 1.5 Vp-p, 300-3300 Hz, Minimum 50 kW ±10% input impedance – 4.6KV isolated.
Low-level Audio Output	1Vp-p ±60% - 4.6KV isolated, via Isolation Board.
High-level Audio Input	Maximum 30 VAC RMS, 0.5A RMS Maximum 0.05 W-output Impedance Minimum signal: 100 mV, 100 µA.
High-level Audio Output	30 V RMS, 0.5 A RMS maximum per one output
EMC	
Electrostatic Discharge	IEC 1000-4-2, level 3
Radiated Electromagnetic Field	IEC 1000-4-3, level 3
Electrical Fast Transient / Burst	IEC 1000-4-4, level 3
Radiated Emission	EN55022

Specifications subject to change without notice.

* The ACT module is not compliant with RoHS European Directive no. 2002/95/EC.

CONFIGURATION

General

For information on setting the 12V DO dip switch in the DO relay module board, see the Digital Output Relay Module chapter above. For information on setting the 12V DO dip switch in the DO relay 120/230V module board (for EE relays only), see the Digital Output Relay 120/230V Module chapter above.

OPTIMIZATION

General

No optimization is required for the ACE3600 units.

OPERATION

General

The operational functions of the ACE3600 unit are performed using the ACE3600 System Tools Suite (STS). These are administrative and diagnostic tasks, generally performed by technicians and administrators. The functions available depend on the specific software applications installed in the unit.

Opening/Closing the Housing Door

For instructions on opening and closing the housing door and locking the door with the optional padlock accessory, see the Opening/Closing the Housing Door section in the Installation chapter.

MAINTENANCE

General

The following maintenance procedures are recommended for the ACE3600 RTU.

Lead Acid Battery Maintenance

It is recommended to perform the following maintenance procedures for the lead acid battery using the ACE STS Hardware Test utility or the user application program:

- Once per month - run a full battery test (battery capacity) of the lead acid battery.
- Once per day - read the charge level of the lead acid battery.

If the capacity is below the manufacturer recommended level, replace the battery. See the Power Supply Module and Backup Battery chapter above.

TROUBLESHOOTING

Symptom	Action
The PWR LED on the CPU/expansion module front panel is not lit.	Check power connections to the unit. If all connections are correct, check cables.
The PWR LED on the CPU/expansion module front panel is solid red.	The CPU/expansion module has received an error from the power supply (AC fail, Bat Error, etc.) or fails to recognize the power supply. Check the AC power supply, backup battery, etc.
The PWR LED on the CPU/expansion module front panel is flashing red.	The boot did not complete and the FPGA is not loaded. Download a new system to the unit.
The ERR LED on the CPU module front panel is red (or the MERR LED on the expansion module is red.)	The unit has a problem. Check the Error Logger to read error message. Note: If there are many errors logged about lost frames, check the expansion Ethernet SPD LED to make sure that the LAN is working at 100Mb.
The ERR LED on the CPU module front panel is orange (or the MERR LED on the expansion module is orange.)	The unit has a warning. Check the Error Logger to read warning.
The ERR LED on the CPU module front panel is green (or the MERR LED on the expansion module is green.)	The unit has a message. Check the Error Logger to read message.
The APPL LED on the CPU module front panel is red.	The user application is not running. Check the Error Logger to read error.
The APPL LED on the CPU module front panel is blinking	The user application is running for more than 1.2 seconds continuously. Check the application.
The CONF LED on the CPU module front panel is red (or the MCNF LED on the expansion module is red.)	There is a configuration error (such as an incompatible plug-in or mismatch between a physical I/O module and the I/O configuration for the frame.) Check the Error Logger to read error.
RTU startup fails and some/all of the four user LEDs are lit.	Check the four LEDs for the binary error code, as described in Table 4-3, and act accordingly.
Startup of expansion module fails and some/all of the four EXP ADDR LEDs are lit.	Check the four Exp Addr LEDs for the binary error code, as described in Table 16-2, and act accordingly.

Symptom	Action
The MCOM LED on the expansion module is red or blinking green.	The expansion module is in the process of loading, initializing, or registering. Wait a few seconds until the LED is solid green for the module to be connected to the main CPU. If the LED continues to blink red slowly, the expansion module has failed in the discovery process with the main CPU. This could be related to one of the following causes: • The main CPU is not fully powered up; • A cable between the main and expansion frame (perhaps via the expansion LAN switch) is not connected properly; • The rotary switch on the expansion module is not set correctly; • The expansion frame is not defined in the site configuration.
The MCNF LED on the expansion module is flashing green after having been solid green (i.e. after connection to main CPU was established.)	The Expansion module is disconnected from the main CPU. Check cable connections.
The ERR LED on the expansion LAN switch front panel is red.	The switch was unable to configure itself upon startup or it has lost communication with the main CPU module. Check the Error Logger to read error message. The switch may need to be replaced.
The communication LEDs on the expansion LAN switch front panel are not lit.	Check if the Ethernet cables are connected properly. Check if the CPU on the main frame and the expansion modules have the proper power.
The power supply is connected to power sources and there is no power in AUX1 and/or AUX2.	Check if the AUX connectors are off due to STS Hardware Test or user application. If not, check if the fuse associated with the AUX is burned out and should be replaced. (One fuse for AUX 1A/1B and another fuse for AUX 2A/2B.) See Break-Fix Procedures chapter.
No communication with WAN, IP Gateway.	Check the unit’s connection to the Ethernet.
The power supply is on, but certain I/O modules are off.	If the I/O modules are DO EE relays, check if the 2-pin TB is plugged into the 12VDO connector on the main power supply.

Symptom	Action
The DO EE relays are connected to the main power supply and the 2-pin TB is not plugged into the 12VDO connector on the main power supply, but the DO EE relays are enabled.	Check the position of the dip switch on the DO EE relays. For more information, see the Digital Output Relay Module chapter above.

BREAK-FIX PROCEDURES

General

IMPORTANT

This chapter refers only to replacement of removable modules, plug-ins, motherboard, power supply fuses, and backup battery. If any other components in the unit require replacement, contact your local service center.

Before replacing modules or plug-ins, see safety issues/warnings in the Installation chapter above.

Note: A TORX screwdriver is required for component replacement. A Philips screwdriver is required for assembling the TB holder and a flat screwdriver is required for setting the code key pin.

For information on installation of the frame/housing on the wall, see the Installation chapter above.

The ACE3600 has a hot swap capability, which means that the modules can be removed from their slots and inserted without powering down the unit. The only exception to this rule is the main power supply module, which cannot be removed during normal operation. See Replacing a Power Supply Module below for details.

If a module is inserted once the system is running, the system will recognize the module, but will not operate it using the application until the unit has been rebooted.

Replacing a CPU/Gateway Module

If the CPU 3680 to be replaced is the active CPU of a redundant site, the standby CPU will become active and continue all control and monitoring of I/Os.

Procedure 29-1 How to Replace a CPU/Gateway Module

1. To replace a CPU module, open the door of the CPU module and press the cable holder downward.
2. Disconnect all cables from the connectors.
3. Simultaneously press on the tabs on the top and bottom of the plastic front of the old module, and pull the module from its slot. See Figure 29-1.

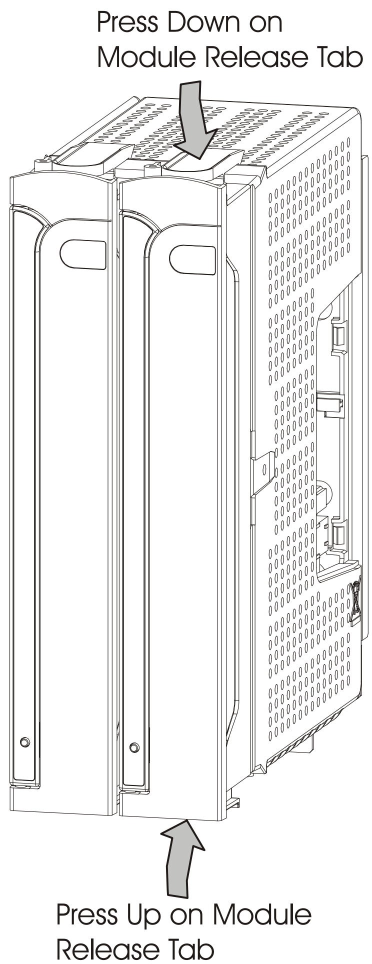
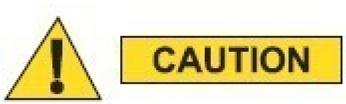


Figure 29-1 ACE3600 Module Release Tabs

4. Remove any SRAM plug-in memory from the old CPU module and plug in to the new CPU module.
5. Slide the new module all the way into the slot until the tabs click into place.
6. Reconnect the cables and press the cable holder back up into place.

Replacing a Power Supply Module



METAL PARTS OF THE POWER SUPPLY MAY BE VERY HOT.
After removing the power supply module, allow the metal parts to cool down before servicing the unit.

Procedure 29-2 How to Replace a Redundant/Expansion Power Supply Module

1. To replace the second power supply module in a site which has redundant power supplies, or an expansion power supply in an I/O expansion frame, open the door of the power supply module and press the cable holder downward.

2. Disconnect the cables from the connectors.

3. Simultaneously press on the tabs on the top and bottom of the plastic front of the old module, and pull the module from its slot.

4. Slide the new module all the way into the slot until the tabs click into place.

5. Reconnect the cables and press the cable holder back up into place.

The main power supply cannot be removed under power and a safeguard is added in order to prevent unplanned removal. (Note: The dual power supply feature is not currently available.)

Procedure 29-3 How to Replace the Main Power Supply Module

1. To replace the main power supply module, open the door of the power supply module.
2. Press down on the top of the main power cable connector to disconnect the user's main power cable from the cable inlet on the bottom of the power supply module front panel.
3. Follow steps 1-5 in Procedure 29-2 to replace the power supply.

Replacing an I/O Module or Expansion LAN Switch

To replace an I/O module or Expansion LAN Switch, follow the procedure below.

Procedure 29-4 How to Replace an I/O Module or LAN Switch

1. If the I/O module includes a TB holder, remove TB holder by pulling on the extractor handles.
   If the I/O module does not include a TB holder, remove the TBs by hand or using one of the TB extractor tools (FHN7063A) provided with the RTU.
2. Simultaneously press on the tabs on the top and bottom of the plastic front of the old module, and pull the module from its slot.
3. Remove any plug-in 24V power supplies from the old I/O module and plug-in to the new I/O module.
4. For DO relay modules, reset the 12VDO dip switch, if necessary. See the Configuration chapter.
5. Slide the new module all the way into the slot until the tabs click into place.
6. If the I/O module includes a TB holder, reconnect the TB holder as described in the I/O Module section.
   If the I/O module does not include a TB holder, replace the TBs on the connectors on the front of the I/O module by hand.

Inserting a New I/O Module into an Empty Slot

When the RTU is shipped, a protective rubber cover is inserted into any empty module slots, on the mother board connectors. The procedure below describes how to remove this cover from the slot and insert a new I/O module onto the RTU frame.

Procedure 29-5 How to Replace an I/O Module

1. Grip the protective rubber cover (p/n 1571435Y04) firmly with your thumb and index finger. Gradually ease the cover out of the desired module slot.
2. Insert the desired I/O module into the empty slot.

Replacing a Plug-in Port on the CPU Module

Procedure 29-6 How to Replace a Plug-in Port on the CPU Module

1. To replace a plug-in port on the CPU module, remove the CPU module from the RTU.
2. Unscrew the two supporting pins on the other side of the CPU board. Save the screws.
3. Unscrew the two supporting pins on the plug-in port. Save the screws.
4. Connect the two supporting pins with screws to the new plug-in port.
5. Replace the plug-in board with the RJ-45 connector facing the panel. Carefully insert the plug-in board connector into the appropriate connector on the CPU board.
   For Ethernet 10/100 MB, use the J14 connector on the CPU (Plug-in 1 only.)
   For all other plug-in ports, use the J5 (Plug-in 1) or J6 (plug-in 2) connector.
6. Connect the two supporting pins with screws to the other side of the CPU board.
7. Replace the CPU module in the slot.

Replacing a Plug-in SRAM Memory Card in the CPU Module

Procedure 29-7 How to Replace a Plug-in SRAM Memory Card in the CPU Module

1. To replace an SRAM memory card on the CPU module, remove the CPU module from the RTU.
2. Remove the old plug-in SRAM memory card from the board.
3. Place the new plug-in SRAM memory card with the connector facing the panel. Carefully insert the plug-in board connector into the connector marked P12 on the CPU board.
4. Secure the memory card to the CPU board with the supplied screw.
5. Replace the CPU module in the slot.

For more information, see Connecting SRAM Expansion Memory to the CPU Module in the CPU Module chapter.

Replacing the Motherboard

To replace the motherboard of the ACE3600 RTU, follow the procedure below.

Procedure 29-8 How to Replace the Motherboard

1. If the unit is installed in a NEMA 4 housing, unscrew the four large screws and remove the metal chassis from the housing.
2. Remove all modules from the outermost slots, generally the power supply module from the leftmost slot and I/O module from the rightmost slot.
3. Unscrew the M5 screws on each side which secure the motherboard to the metal chassis. Save the screws. See Figure 29-2.

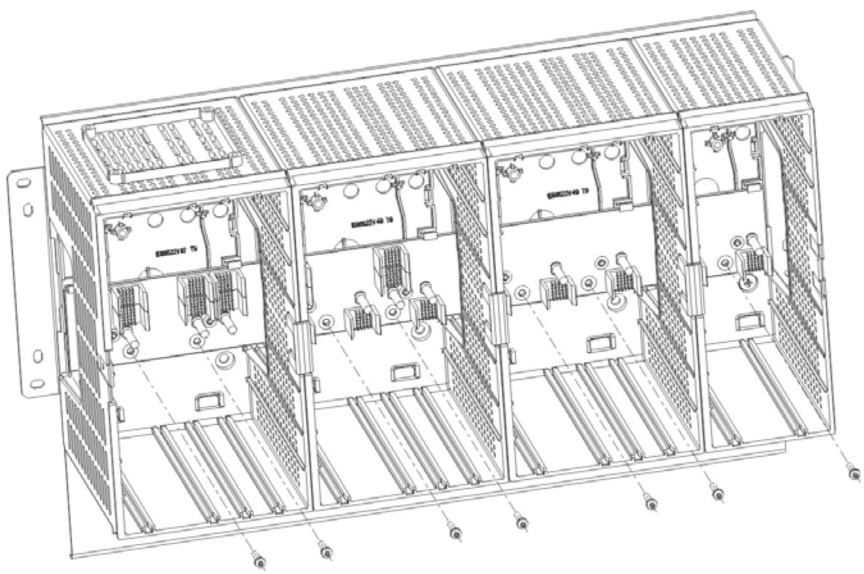


Figure 29-2 ACE3600 Motherboard on Metal Chassis

4. From inside the cage, push out the small cover on the side of the RTU cage. Save the cover.
5. Slide the damaged motherboard out of the cage, through the opening on the side of the RTU cage.
6. Slide the new motherboard into the frame, through the opening on the side of the RTU cage.
7. Secure the motherboard to the cage and metal chassis using the M5 screws saved in step 3.
8. Replace the cover on the cage.
9. If the unit was installed in a NEMA 4 housing, replace the metal chassis in the housing and screw the four large screws from the metal chassis into the housing.
10. Replace the modules in their respective slots.
11. Make sure that the ground is reconnected.

Replacing the Fuses on the Power Supply Module for AUX1/AUX2 or I/O Expansion

To replace a fuse for AUX1 1A/1B or AUX2 2A/2B on the power supply module, or one of the fuses on the expansion power supply, follow the procedure below.

Procedure 29-9 How to Replace the Fuse for AUX1 1A/1B or AUX2 2A/2B or I/O Expansion

1. Disconnect the cables from the connectors. If the faulty fuses are attached to the main power supply, press down on the top of the main power cable connector to disconnect the user's main power cable from the cable inlet on the bottom of the power supply module front panel.
2. Simultaneously press on the tabs on the top and bottom of the plastic front of the old module, and pull the module from its slot.
3. Using narrow pliers, remove the faulty fuse from its groove on the board. For a diagram of the fuses in the expansion power supply, see Expansion Power Supply Fuses in the Expansion Power Supply Module chapter above.
4. Press the new fuse into the groove on the board.
5. Slide the power supply module all the way into the slot until the tabs click into place.
6. Reconnect the cables as in installation.

Replacing the Backup Battery on the RTU

For instructions on replacing the backup battery on the RTU, see Replacing the Backup Battery in the Power Supply and Backup Battery chapter above.

Interconnection Diagrams

All internal electrical connections except for the main power, ground and battery are performed in the factory and supplied with the RTU. The electrical interconnection diagrams are provided below.

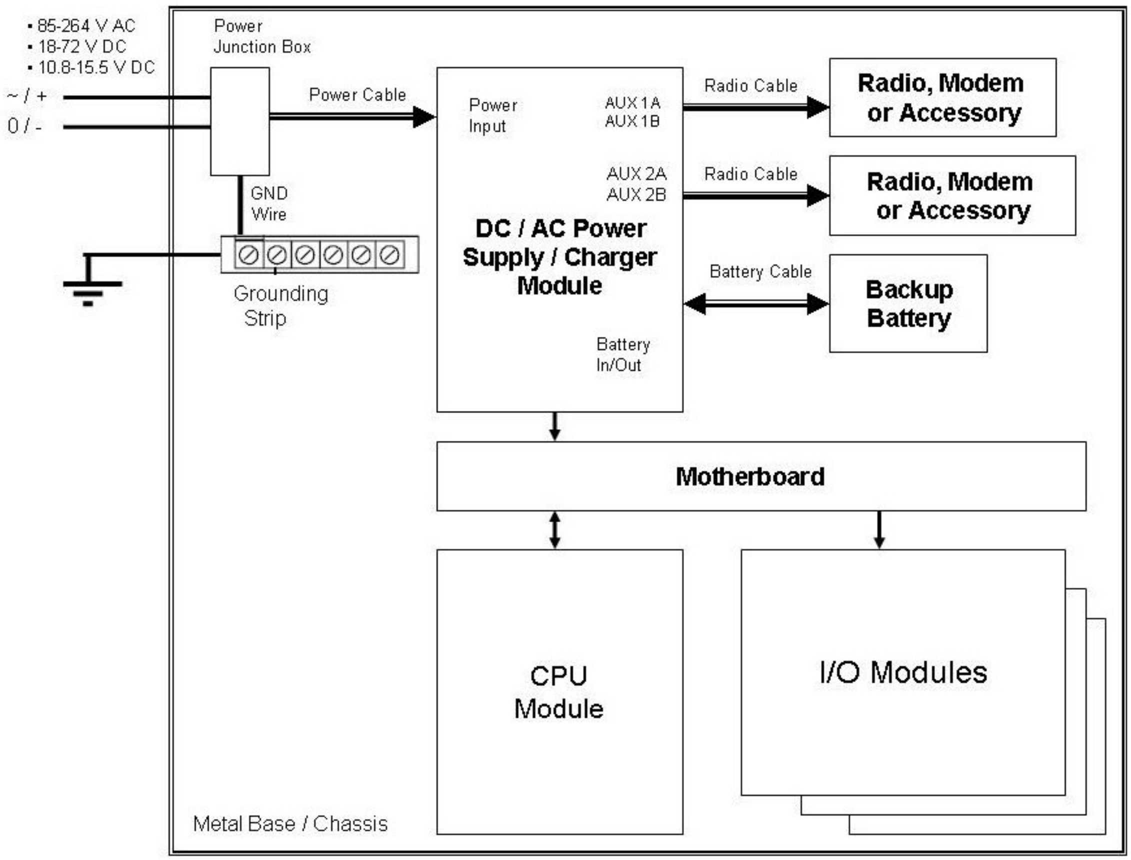


Figure 29-3 Electrical Interconnection (RTUs with I/O slots)

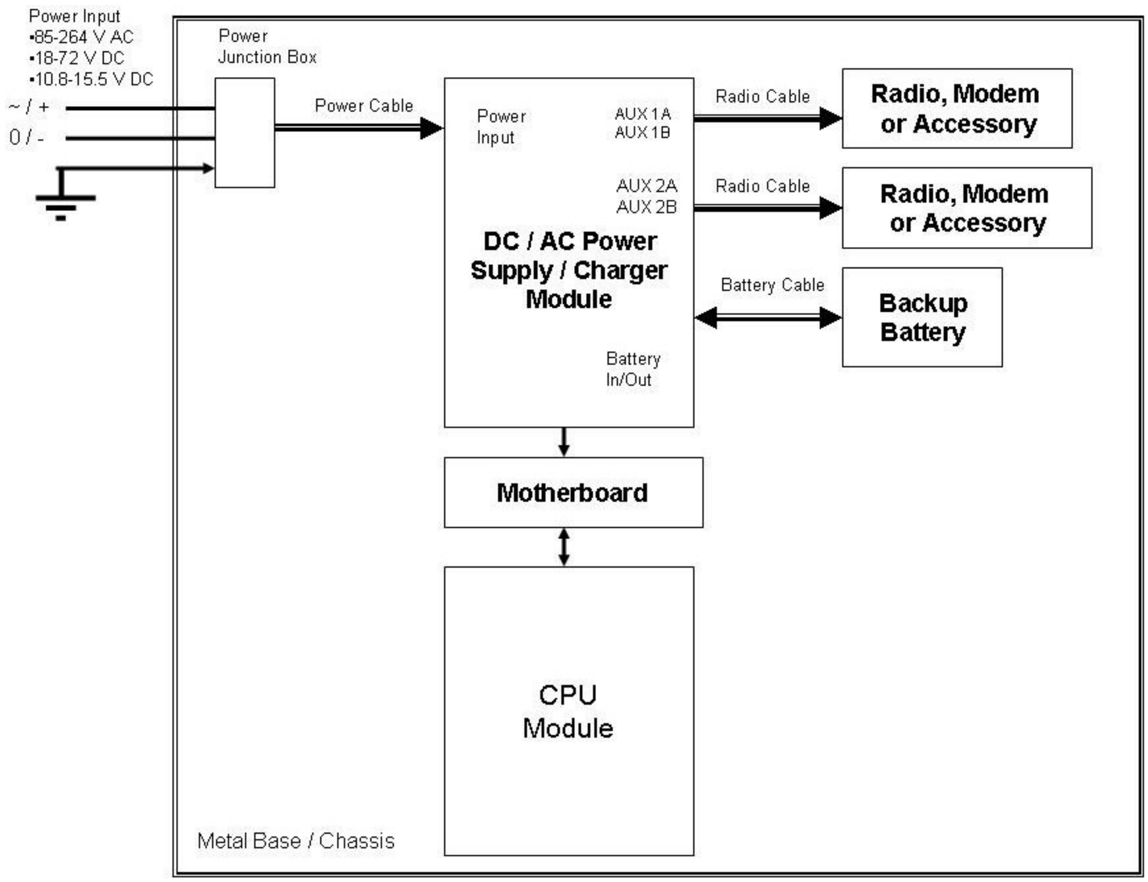


Figure 29-4 Electrical Interconnection (RTUs with no I/O slots)

APPENDIX A: GENERAL SPECIFICATIONS

Specifications

The specifications below are for the RTU as a whole. For the individual technical and performance specifications of each module in the RTU, see the specific module chapter.

Table A-1 ACE3600 Specifications

General	
Frames	No I/O slots - PS and CPU modules only, wall mount, Dimensions (WxHxD): 117 x 209 x 198* mm (4.61" x 5.30" x 7.80"*), Weight: 0.95 Kg (2.1 lb) 2 I/O slots - PS, CPU and 2 I/O modules, wall mount, Dimensions (WxHxD): 194 x 244 x 198* mm (7.64" x 9.61" x 7.80"*), Weight: approx. 1.6 Kg (3.56 lb) 3 I/O slots - PS, CPU and 3 I/O modules, wall mount, Dimensions (WxHxD): 234 x 244 x 198* mm (9.21" x 9.61" x 7.80"*), Weight: approx. 1.9 Kg (4.19 lb) 5 I/O slots - PS, CPU and 5 I/O modules, wall mount, Dimensions (WxHxD): 314 x 244 x 198* mm (12.36" x 9.61" x 7.80"*), Weight: approx. 2.4 Kg (5.3 lb) 7 I/O slots - PS, CPU and 7 I/O modules; wall mount, Dimensions (WxHxD): 391 x 244 x 198* mm (15.39" x 9.61" x 7.80"*), Weight: 3.0 Kg (6.6 lb) 8 I/O slots - PS, CPU and 8 I/O modules, wall mount OR 19" rack Dimensions (WxHxD): 435 x 244 x 198* mm (17" x 9.61" x 7.80"*), Weight: approx. 3.3 Kg (7.3 lb) Redundant CPU and power supply frame - Dual PS, Dual CPU, and 4 I/O modules; wall mount OR 19" rack, Dimensions (WxHxD): 391 x 244 x 198* mm (15.39" x 9.61" x 7.80"*), Weight: 3.0 Kg (6.6 lb) * Depth including Module panel

General

Expansion Frame	Number of I/O slots - 3, 5, 7, or 8 Default power supply - Expansion power supply Compatible power supplies - All except: 10.8-16V DC low-tier power supply
Metal Chassis	19" frame metal back - for PS, ACE IP Gateway, radio and 6.5 or 10 Ah backup battery, 2 accessory boxes; wall/rack mount, OR PS, CPU, radio and 6.5 or 10 Ah backup battery, 0, 3, 5, 8 I/O slot frame, up to 2 accessory boxes, wall/rack mount, Dimensions (WxHxD): 434.5 x 310.4 x 200* mm (17.11"x 12.22" x 7.88"*). Large - for PS, CPU and up to 7 I/O slot frame, two radios and 6.5 or 10 Ah backup battery, wall mount, Dimensions (WxHxD): 448 x 468 x 200* mm (17.64" x 18.43" x 7.88"*) Medium - for PS, CPU and up to 3 I/O slot frame, one radio and 6.5 Ah backup battery, wall mount, Dimensions (WxHxD): 335 x 355 x 198* mm (13.19" x 13.98" x 7.8"*) Small - for PS, CPU, 2 I/O slot frame, 1 radio (or 1 accessory box), and 6.5Ah backup battery, wall mount, Dimensions (WxHxD): 264 x 365 x 200* mm (11.02"x 14.17" x 7.88"*). * Depth including Frame and Module
Housing	Large Nema 4/IP66 painted metal - up to 7 I/O slot frame, two radios and 6.5 or 10 Ah, backup battery, Dimensions (WxHxD): 500 x 500 x 210 mm (19.7" x19.7" x 8.26") Small Nema 4/IP66 painted metal - up to 3 I/O slot frame one radio and 6.5 Ah backup battery, Dimensions (WxHxD): 380 x380 x 210 mm (15" x 15" x 8.26")
Power Supply	10.8-16 V DC low-tier 10.8-16 V DC (default) 18-72 V DC 18-72 V DC with 12V smart battery charger 100-240 V AC, 50-60 Hz 100-240 V AC, 50-60 Hz, with 12V smart battery charger 10.8-16 V DC Expansion
Backup Battery	6.5 Ah - Sealed Lead-Acid 10 Ah - Sealed Lead-Acid

General	
Operating Temperature	-40 ºC to +70 ºC (-40 ºF to 158 ºF) Notes: 1) When using a metal housing option, the maximum operating temperature outside the housing is +60 ºC (140 ºF). 2) ACT module and Motorola radios operating temperature range is: -30 ºC to +60 ºC (-22 ºF to 140 ºF). The full operating temperature range is supported when using redundant 12V power supplies. When using dual AC power supply or dual 18-72 V DC power supply, the maximum ambient operating temperature of the RTU is limited to: • 50°C (122°F) - when installed inside a metal chassis or closed cabinet. • 60°C (140°F) - when installed without enclosure or closed cabinet.
Storage Temperature	-55 ºC to +85 ºC (-67 ºF to 185 ºF)
Operating Humidity	5% to 95% RH @ 50 ºC without condensation
Mechanical Vibrations	Per EIA / TIA 603 Base-station, Sinusoidal 0.07mm @ 10 to 30 Hz, 0.0035 mm @ 30-60 Hz
Operating Altitude	-400m to +4000 meter (-1312 ft to + 13120 ft) above sea level Note: When using 18-72V DC or 100-240 VAC Power supply the operating altitude is -400 to +3000m

Regulatory Standards	
Safety	UL 60950-1 (UL listed), CSA 22.2-950-1, EN60950-1, IEC 60950-1, AS/NZS 60950 FM/cFM certified as Nonincendive Class I, Division 2 - standard FM 3611 (Note: FM approval refers to model F7509 only and most of the ACE3600 options.)
Emission	Emission standards for industrial environments CFR 47 FCC part 15, subpart B (class A); CE EMC: EN50081-2/EN61000-6-4 (CISPER 11 / EN55011 class A)
Immunity	Immunity standards for industrial environments Per EN50082-2 /IEC 61000-6-2

Communications

Communication Ports	Up to 5 ports per CPU (CPU 3640), up to 8 ports per CPU (CPU 3680/ 4600) Serial - up to 4 RS232 ports Multi-drop – up to 3 RS485 port Ethernet - up to 2 10/100 MB ports and 1 10 MB Two-way radio / analog trunked radio - up to 2 modem ports USB Host for MotoTrbo- up to 2 ports Internal Ethernet 10/100 Mb/s port (for redundant CPU configuration)
Motorola Radio Support	Mobile conventional two-way radios – CM 200 , CM 340, GM 3188, EM 200, CDM750 Portable conventional two-way radios – HT750, GP320, GP328, PRO5150 Analog trunked radios – XTL5000, XTL2500 Digital trunked radios – XTL5000, XTL2500, XTS2500, MTM800 (TETRA) MotoTrbo radios –XPR4350/4380, DM3400, XiR M8220, DGM4100
Third Party Radio Support	Two-way radios, Data radios, TETRA radios (PD)
Modem Support	Dial-up modems, Cellular modems (dial mode and PD)
Protocols	MDLC, TCP, UDP, IP, PPP, NTP, DHCP
Third Party Protocol Support	MODBUS RTU: master /slave on RS232/RS485/Ethernet, DF1 (Allen Bradley): master on RS232 DNP 3.0: master/slave on RS232/RS485/Ethernet IEC 60870-5-101: slave on RS232
User Protocol (user program)	Possible on RS232, RS485 and Ethernet ports

Specifications subject to change without notice.

APPENDIX B: ENVIRONMENTAL PROTECTION

Disposal of Components

All components of the ACE3600 should be properly disposed of, in accordance with local regulatory standards and laws.

All ACE3600 models comply with RoHS European Directive no. 2002/95/EC (Restriction of the use of Hazardous Substances) and WEEE Directive no. 2002/96/EC (Strategy of Waste management), with the exception of parts:

- XTL5000 radio (included in models F7523A/F7513A/F7524A/F7514A/F7585A/F7586A)
- XTL2500 radio (F7533A/F7593A/F7534A/F7594A/F7538A/F7598A)
- XTS2500 radio (F7543A/F7544A/F7548A)
- CDM750 radio (F7563A/F7564A)
- ACT Module (option V155AE and kit FLM)

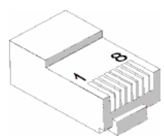
Note: The ACE3600 RTU is categorized as Monitoring and Control Equipment. Currently (2010) Monitoring and Control Equipment are exempt from RoHS compliance. This exemption may be cancelled in the future.

APPENDIX C: ACCESSORIES, ADAPTORS, AND CABLES

General

NOTE

Note: On all of the Motorola RJ45 connector heads (except for Ethernet cables), the numbering of the pins is different than the standard, as shown in the figure below. Pin 1-8 are left to right rather than right to left, as shown below. Therefore, only original Motorola cables should be used.



This appendix provides the information required for connecting an RTU RS232 port to various units, as detailed below:

- Connection to a computer/terminal (MDLC protocol or User port)
- Connection to a modem (MDLC protocol or User port)
- Connection to the GPS receiver (Motorola Binary protocol)
- Connecting a User port to a printer
- Connecting a User port to an external unit
- Connection to a radio (MDLC and PPP protocols)
- RTU-to-RTU connection using MDLC protocol through RS232 ports (RS-Link)
- ACE3600 RTU-to-ACE3600 RTU connection using MDLC protocol through RS485 ports (RS-Link)
- ACE3600 RTU-to-MOSCAD RTU connection using MDLC protocol through RS485 ports (RS-Link)
- ACE3600 RTU-to-PC Ethernet port connection without a hub

Connection to a Computer or Terminal

To connect one of the RTU RS232 ports to a computer/terminal, use the FLN6457B adaptor, which ends with the female 25-pin or 9-pin, D-type connector. The port may be defined either as a MDLC protocol port or as a User port.

The signals that appear on the female 25-pin or 9-pin D-type connector are according to the RS232 standard – see the following table. In this case, the RTU serves as DCE (Data Communication Equipment).

RS232 Function	8-pin Connector (on RTU)	25-pin Female	9-pin Female	Direction
TX-DATA	2 ←	2	3	from DTE
RX-DATA	1 →	3	2	to DTE
RTS	5 ←	4	7	from DTE
CTS	8 →	5	8	to DTE
DSR	7 →	6	6	to DTE
GND	4	7	5	-
DTR	3 ←	20	4	from DTE
DCD (Rec line)	6 →	8	1	to DTE

To extend the cable, you may use any extension cable with male and female D-type connectors (connected pin-to-pin, not crossed).

Note: When a User port is defined as Computer/Terminal with DTR support:

The RTU will not transmit unless it receives DTR=ON from the computer/terminal.

The RTU will not receive unless it receives RTS=ON from the computer/terminal.

Connection to a Modem

To connect one of the RTU RS232 ports to an RS232 modem, use one of the adaptors provided in kit FLN6458B (option V213AE):

- 9-pin adaptor for Async (#0189968V32)
- RS232-E adaptor (#0189968V33) as in Connection to IDEN Radio below.
- RS232-E+ adaptor (#0189968V34) as in Connection to TETRA Radio below.

The asynchronous adaptor (#0189968V32) ends with the male 9-pin D-type connector. The port may be defined either as a MDLC protocol port or as a User port.

The signals that appear on the male 9-pin D-type (or 25-pin) connector are according to the RS232 standard – see the following table. In this case, the RTU serves as DTE (Data Terminal Equipment).

RS232 Function	8-pin Connector(on RTU)	25-pin Male	9-pin Male	Direction
TX-DATA	1 →	2	3	from RTU
RX-DATA	2 ←	3	2	to RTU
RTS	6 →	4	7	from RTU
CTS	3 ←	5	8	to RTU
GND	4	7	5	-

RS232 Function	8-pin Connector(on RTU)	25-pin Male	9-pin Male	Direction
DTR	8 →	20	4	from RTU
DCD (Rec line)	5 ←	8	1	to RTU

To extend the cable, you may use any extension cable with male and female D-type connectors (connected pin-to-pin, not crossed).

Before transmitting, the RTU sends RTS=ON to the modem, and waits for CTS=ON from the modem as a condition for transmitting.

The RTU will receive data from the modem only when DCD=ON.

When using a modem in auto-answer mode (connected to a Computer port) for remote service, the RTU does not support RTS/CTS protocol since the port is designated to operate with a local computer as well as with a modem.

For modems which support RS232-E, use either the RS232-E adaptor (#0189968V33) as in Connection to IDEN Radio below, or the RS232-E+ adaptor (#0189968V34), as in Connection to TETRA Radio below.

Connection to GPS Receiver

When an off-the-shelf GPS timing receiver is purchased (e.g. Synergy SynPaQ/E PPS Sensor with M12+), the data and power cable for that receiver should be purchased as well.

Connect the data wire of the cable to the CPU port using the ACE3600 asynchronous RS232-E adaptor cable. The port should be defined as a GPS receiver port (RS232, Async).

Connect the power wire of the cable to a cable with the following connectors:

RTU side: The connector should fit the auxiliary power connector on the ACE3600 power supply module.

GPS Receiver side: The connector should fit the power connector on the GPS receiver cable.

Connecting a User Port to a Printer

To connect one of the RTU RS232 ports defined as a User port to a printer, you may use one of the two cables described in the previous paragraphs. Since the connection to the printer is not defined by the RS232 standard, every printer manufacturer has defined the connectors for his own convenience. Therefore, select the adaptor according to the functions of the various pins.

If the FLN6458B adaptor (with the male 9-pin D-type connector) is used, refer to the following table.

RS232 Function	9-pin Male	Used as	Direction
TX-DATA	3	Serial Data	to Printer
CTS	8	Printer Ready	from Printer
GND	5	GND	-

If the FLN6457B adaptor (with the female 9-pin, D-type connector) is used, refer to the following table.

RS232 Function	9-pin Female	Used as	Direction
RX-DATA	2	Printer Rx-Data	to Printer
DTR	4	Printer Ready	from Printer
GND	5	GND	-

Connecting a User Port to an External Unit

To connect one of the RTU RS232 ports defined as a User port to an external unit (which supports RS232), you may use one of the two adaptors (FLN6457B or FLN6458B) according to the port definition in the site configuration.

If the FLN6457B adaptor is used, refer to the pin assignment given in Connection to a Computer or Terminal in this chapter.

If the FLN6458B adaptor is used, refer to the pin assignment given in Connection to a Modem in this chapter.

Connection to a Radio

For detailed instructions on connecting a radio to the ACE3600 RTU, see the Radio Types and Installation Kits chapter above.

Connection to IDEN Radio

To connect the RTU (via onboard serial or plug-in port) to an IDEN radio, use an adaptor which ends with the male 9-pin, D-type connector. The port should be defined as RS-232, Async, PPP, iDEN, MDLC over IP.

RS232 Function	8-pin Connector(on RTU)	9-pin Male	Direction
TX-DATA	1 →	3	from RTU
RX-DATA	2 ←	2	to RTU
CTS	3 ←	8	to RTU
GND	4	5	-
CD (Rec line)	5 ←	1	to RTU
RTS	6 →	Not used	
	7 →	4	from RTU
DTR	8 →	7	from RTU

Connection to TETRA Radio

To connect the RTU (via onboard serial or plug-in port) to a TETRA radio, use an RS232-E+ type adaptor which ends with the male 9-pin, D-type connector. The port should be defined as RS232, Async, PPP, Tetra, MDLC over IP.

RS232 Function	8-pin Connector(on RTU)	9-pin Male	Direction
TX-DATA	1 →	3	from RTU
RX-DATA	2 ←	2	to RTU
CTS	3 ←	8	to RTU
GND	4	5	-
CD (Rec line)	5 ←	1	to RTU
RTS	6 →	4	from RTU
	7	Not used	
DTR	8 →	7	from RTU

Connection to MotoTrbo Radio

To connect the RTU (via Host USB port) to a MotoTrbo radio, use a cable FKN8644A. The port should be defined as **USB Host, Async, Remote NDIS Host, MotoTrbo.**

Function	USB Type A (on RTU)	26-pin Female (on Radio)	Direction
+5 VDC/ VBUS+	1 →	3	from RTU
Data -	2 ↔	2	to/from RTU
Data +	3 ↔	1	to/from RTU
GND	4	4	-
Ignition		25	from radio power cable

RTU-to-RTU Connection Using MDLC Protocol through RS232

To establish a link between two RTUs using MDLC protocol, the ports of both RTUs should be defined as RS232 RTU-to-RTU (RS-Link). The ports of the two RTUs should be connected by the FLN6457B and FLN6458B adaptors, when the adaptors are connected.

IMPORTANT

Do not connect between RTUs without the adaptor cables. A direct connection will cause a short circuit between the pins that have the same function.

RTU-to-RTU Synchronous Communication Using Plug-in Port

The pin assignment of the cable to be used for RTU-to-RTU synchronous communication (using a plug-in port) is given below.

RS232 Function	8-pin Connector (on sending RTU)	8-pin Connector (on receiving RTU)	Direction
TX-DATA	1 →	2 ←	from RTU
RX-DATA	2 ←	1 →	to RTU
CTS	3 +6 →*	5 ←	from RTU
Signal GND	4	4	-
CD (Rec line)	5 ←	3 +6 →*	to RTU
RTS	6 +3 →*	5 ←	from RTU
TX_CLK	7 →	8 ←	from RTU
RX_CLK	8 ←	7 →	to RTU

*Pins 3 and 6 are shorted.

ACE3600 RTU-to-ACE3600 RTU Connection Using MDLC Protocol through RS485

To establish a link between more than two ACE3600 RTUs using MDLC protocol, the ports of all RTUs should be defined as RS485 RTU multidrop. The ports of the RTUs should be connected using the RS485 connection box V186AD (FLN3641A). Cable FKN8427A should be connected between ACE3600 RS485 port and one of the seven inlets of the connection box.

RS485 Function	8-pin Connector* (on ACE3600)
B (RX/TX-)	1
A (RX/TX+)	8

*Note: All seven connectors are shorted.

ACE3600 RTU-to-MOSCAD RTU Connection Using MDLC Protocol through RS485

To establish a link between an ACE3600 unit and a MOSCAD RTU using MDLC protocol, the ports of both RTUs should be defined as RS485 RTU multidrop. The ports of the two RTUs should be connected using the FKN8527A cable.

IMPORTANT

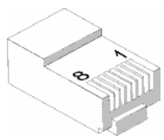
Do not connect between RTUs without the adaptor cables. A direct connection will cause a short circuit between the pins that have the same function.

RS485 Function	8-pin Connector (on ACE3600)	4-pin Connector (on MOSCAD)
B (RX/TX-)	1	2
A (RX/TX+)	8	3

ACE3600 RTU-to-PC Ethernet Port Direct Connection without Hub

NOTE

Note: The RJ45 connector head for this connection is standard. The numbering of the pins is according to the standard, as shown in the figure below. Pin 1-8 are right to left, as shown below. Therefore, any standard Ethernet crossover cable may be used.



To establish a link between an ACE3600 unit and the Ethernet port of a PC, without using a hub, the RTU port should be defined as an IP port (10/100 BT, Static, Ethernet LAN) with an IP address. The ports should be connected using an Ethernet crossover cable.

IP Function	8-pin Connector (Plug 1)	8-pin Connector (Plug 2)
TX-DATA +	1 →	3 ←
TX-DATA -	2 →	6 ←
RX-DATA +	3 ←	1 →
N/A	4	7
N/A	5	8
RX-DATA -	6 ←	2 →
N/A	7	4
N/A	8	5

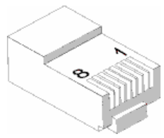
ACE3600 RTU Main CPU to Expansion Module Direct Connection

To establish a direct link between an ACE3600 main frame CPU and an expansion module, the CPU's ETH1 port must be configured either as Static LAN or as I/O Expansion Comm. Connect the CPU's ETH1 port and the expansion module's Exp. Eth1 port using an Ethernet crossover cable, with wiring as in ACE3600 RTU-to-PC Ethernet Port Direct Connection without Hub above.

ACE3600 RTU Main CPU to Expansion Module Connection via LAN Switch

NOTE

Note: The RJ45 connector head for this connection is standard. The numbering of the pins is according to the standard, as shown in the figure below. Pin 1-8 are right to left, as shown below. Therefore, any standard Ethernet cable may be used.



The ACE3600 RTU main CPU can be connected to an expansion module via one or two expansion LAN switches. The CPU's ETH1 port must be configured either as Static LAN or as I/O Expansion Comm.

For the connections below, use a standard standard Category 5E shielded (FTP) LAN cable (up to 50m.)

- ACE3600 RTU main CPU to expansion LAN switch connection or connection of the first LAN switch to the second, if such exists (for systems with I/O expansion only)
- ACE3600 RTU expansion LAN switch to expansion module connection (for systems with I/O expansion only)

IP Function	8-pin Connector (Plug 1)	8-pin Connector (Plug 2)
TX-DATA +	1 →	1 ←
TX-DATA -	2 →	2 ←
RX-DATA +	3 ←	3→
N/A	4→	4←
N/A	5→	5←
RX-DATA -	6 ←	6→
N/A	7→	7←
N/A	8→	8←

APPENDIX D: ACE3600 MAXIMUM POWER RATINGS

Power Rating Tables

The tables below list the typical maximum power consumption (at room temperature) for each of the ACE3600 RTU building blocks (CPU, Power Supply, I/O modules, radios, etc.) and the maximum peak power allowed for a fully loaded RTU, based on the housing type.

The values in the tables below are derived by using the power supply (AC: 100 to 240 VAC or DC: 18 to 72 VDC and 13.8 VDC) and have the power supply efficiency factor included in them.

Before deploying your RTU, add up the power consumption of all components of your system to verify that it is within the maximum peak power for your housing type. In systems with I/O expansion, consider all modules which consume power from their respective AC/DC main power sources when calculating the required power requirements.

Table D-1 Maximum Peak Power Allowed for Fully Loaded RTU

Housing Type Description	Maximum Input Power into Power Supply Module (Watts)
19" Rack (w/out metal enclosure)	100
Large NEMA metal housing (50x50 cm)	120[*]
Small NEMA metal housing (40x40 cm)	105[*]

[*] NOTE: When powered at Vin = 100VAC, the maximum input power of the power supply module is limited to 80 Watts ONLY.

Table D-2 Power Consumption per RTU Module

Module Name	Self Power Consumption (no active I/O) (Watts)	Maximum Power Consumption per Active I/O (Watts)	Self Power Consumption (no active I/O) Watts	Maximum Power Consumption per Active I/O Watts	Maximum Power Consumption all I/Os, LEDs Active Watts
	AC: 100 to 240 VAC DC: 18 to 72 VDC		Vin = +13.8 VDC		
Power Supply (maximum)	12.60	N/A	2.20 (156 mA) (12 VDC Power Supply Module ONLY)	N/A	N/A
Power Supply (Expansion)	0.0	N/A	0.0	N/A	N/A
CPU (3640/3610[*])	5.20	N/A	4.20 (304 mA)	N/A	4.00 (290 mA)
Expansion Module	5.20	N/A	4.20 (304 mA)	N/A	4.00 (290 mA)
Expansion LAN Switch	1.50	0.220	1.20 (87 mA)	0.176 (12.75 mA)	3.10 (225 mA) (x8 ports ON)
Digital Input Fast 24V (x16/x32)	0.100	0.100 (powered by internal 24V PS)	0.080 (5.8 mA)	0.100 (7 mA) (powered by internal 24V PS)	3.50 (254 mA) (x32 inputs ON powered by x1 internal 24V PS)
Digital Input Fast 24V IEC Type 2 (x16/x32)	0.100	0.230 (powered by internal 24V PS)	0.080 (5.8 mA)	0.230 (17 mA) (powered by internal 24V PS)	8.20 (594 mA) (x32 inputs ON powered by x2 internal 24V PS)
Digital Input Fast 48V (x32)	0.100	0.100 (powered by internal 24V PS)	0.080 (5.8 mA)	0.100 (7 mA) (powered by internal 24V PS)	3.50 (254 mA) (x32 inputs ON powered by x1 internal 24V PS)
Digital Input 120/230V	0.100	0.015	0.080 (5.8 mA)	0.012 (1 mA)	0.524 (38 mA) (x16 inputs ON)

[*] The CPU 3610 model has been discontinued.

Module Name	Self Power Consumption (no active I/O) (Watts)	Maximum Power Consumption per Active I/O (Watts)	Self Power Consumption (no active I/O) Watts	Maximum Power Consumption per Active I/O Watts	Maximum Power Consumption all I/Os, LEDs Active Watts
	AC: 100 to 240 VAC DC: 18 to 72 VDC		Vin = +13.8 VDC		
Digital Output ML Relay (x8/x16)	0.120	0.010	0.100 (7.2 mA)	0.008 (0.5 mA)	0.483 (35 mA) (x16 relays ON)
Digital Output EE Relay (x8/x16)	0.170	0.200	0.136 (10 mA)	0.160 (11.6 mA)	3.26 (236 mA) (x16 relays ON)
Digital Output SBO EE Relay (x8)	0.170	0.400	0.136 (10 mA)	0.320 (23.2 mA)	3.26 (236 mA)
Digital Output ML Relay 120/230V	0.200	0.006	0.160 (11.6 mA)	0.005 (0.4 mA)	0.248 (18.0 mA) (x12 relays ON)
Digital Output EE Relay 120/230V	0.290	0.260	0.232 (17 mA)	0.210 (0.15 mA)	3.12 (226 mA) (x12 relays ON)
FET Digital Output/Digital Input	0.120	DI = 0.014 (per input channel) DO = 0.014 (per output channel)	0.100 (7.2 mA)	DI = 0.011 (per input channel) DO = 0.011 (per output channel)	0.552 (40 mA) (x32 LEDs/ inputs ON)
Mixed I/O (DO ML +DI IEC Type 2)	0.480	DI = 0.250 (powered by internal 24V PS) DO = 0.010	0.384 (28 mA)	DI = 0.250 (powered by internal 24V PS) DO = 0.008	4.70 (341 mA) (x4 relays ON x16 inputs ON x4 AI ON powered by internal 24V PS)

Module Name	Self Power Consumption (no active I/O) (Watts)	Maximum Power Consumption per Active I/O (Watts)	Self Power Consumption (no active I/O) Watts	Maximum Power Consumption per Active I/O Watts	Maximum Power Consumption all I/Os, LEDs Active Watts
	AC: 100 to 240 VAC DC: 18 to 72 VDC		Vin = +13.8 VDC		
Mixed I/O (DO EE + DI IEC Type 2)	0.480	DI = 0.250 (powered by internal 24V PS) DO = 0.200	0.384 (28 mA)	DI = 0.250 (powered by internal 24V PS) DO = 0.160	5.50 (400 mA) (x4 relays ON x16 inputs ON x4 AI ON powered by internal 24V PS)
Analog Output	1.10	0.600 (per output channel @20.0 mA)	0.880 (64 mA)	0.480 (35 mA) (per output channel @20.0 mA)	3.33 (241 mA) (x4 outputs sourcing 20.0 mA)
Mixed Analog Current/Voltage	1.40	0.600 (per output channel @20.0 mA)	1.12 (81 mA)	0.480 (35 mA) (per output channel @20.0 mA)	3.61 (261 mA) (x4 outputs sourcing 20.0 mA)
Analog Input Current/Voltage (x8/x16)	0.530	N/A	0.440 (32.0 mA)	N/A	0.870 (63.0 mA)
24V Floating Plug-In Power Supply (No load)	0.410	N/A	0.328 (24 mA)	N/A	N/A
24V Floating Plug-In Power Supply (externally loaded 150 mA)	4.80	N/A	3.84 (278 mA)	N/A	N/A

Plastic Box Interface	Typical Power (Watts)	Power when all I/Os are on (Watts)	Typical Power (Watts)	Power when all I/Os are on (Watts)
	AC: 100 to 240 VAC DC: 18 to 72 VDC		Vin = +13.8 VDC	
Audio Control and Tone (ACT) Module	0.60	2.20	0.480 (35 mA)	1.76 (127.50 mA)

Radios	Power in RX Mode (Watts)	Power in TX Mode (Watts)	Power in RX Mode (Watts)	Power in TX Mode (Watts)
	AC: 100 to 240 VAC DC: 18 to 72 VDC		Vin = +13.8 VDC	
XTL5000 (15 Watt)	8.80	66.90	7.10 (515 mA)	53.50 (4.0 A)
XTL2500 (15 Watt)	8.80	66.90	7.10 (515 mA)	53.50 (4.0 A)
XTS2500 (3 Watt)	1.20	9.90	1.00 (72.5 mA)	8.00 (580 mA)
HT750/GP320/PRO5150/GP328 (UHF 4 Watt/ VHF 5 Watt)	0.70	13.10	0.560 (40.6 mA)	10.50 (761 mA)
CM200/CM140/ EM200/GM3188 (UHF 20 Watt/ VHF 25 Watt)	3.70	75.10	3.00 (217 mA)	60.00 (4.40 A)
GM328/338/339 /340 (UHF 20 Watt/ VHF 25 Watt)	3.60	73.20	2.90 (210 mA)	59.00 (4.3 A)
CDM750 (UHF 20 Watt/VHF 25 Watt)	3.90	74.50	3.20 (232 mA)	60.00 (4.40 A)
XPR4350/4380 DM3400/ XiR M8220/ DGM4100 UHF 20 Watt/ VHF 25 Watt)	10.50	51.5	8.4 (600 mA)	41.5 (3 A)

APPENDIX E: CPU AND POWER SUPPLY REDUNDANCY

General

The ACE3600 CPU and power supply redundant configuration enables installation of two redundant CPUs (CPU3680 only) and two redundant power supply modules. The redundant CPU configuration is supported only by the CPU 3680 module, which enables motherboard Ethernet interconnection between the two CPUs. The CPU redundancy ensures continuous RTU operation if one CPU fails. The redundant power supply configuration ensures the supply of the required RTU voltages when one of the power supplies fails.

For detailed information on configuring and programming CPU and power supply redundancy, see the RTU Redundancy section of the ACE3600 STS Advanced Features manual.

Redundant CPU and Power Supply Frame

The redundant CPU and power supply configuration requires the dedicated dual power supply, dual CPU and 4 I/O slots frame and motherboard.

This frame fits a wall mount installation, large metal chassis and large housing or 19” metal base options.

Redundancy Definitions

- Primary CPU/power supply – Leftmost CPU/power supply
- Secondary CPU/power supply – Rightmost CPU/power supply
- Active CPU – the CPU that controls the I/O modules.
- Standby CPU – the CPU that does not control the I/O modules.

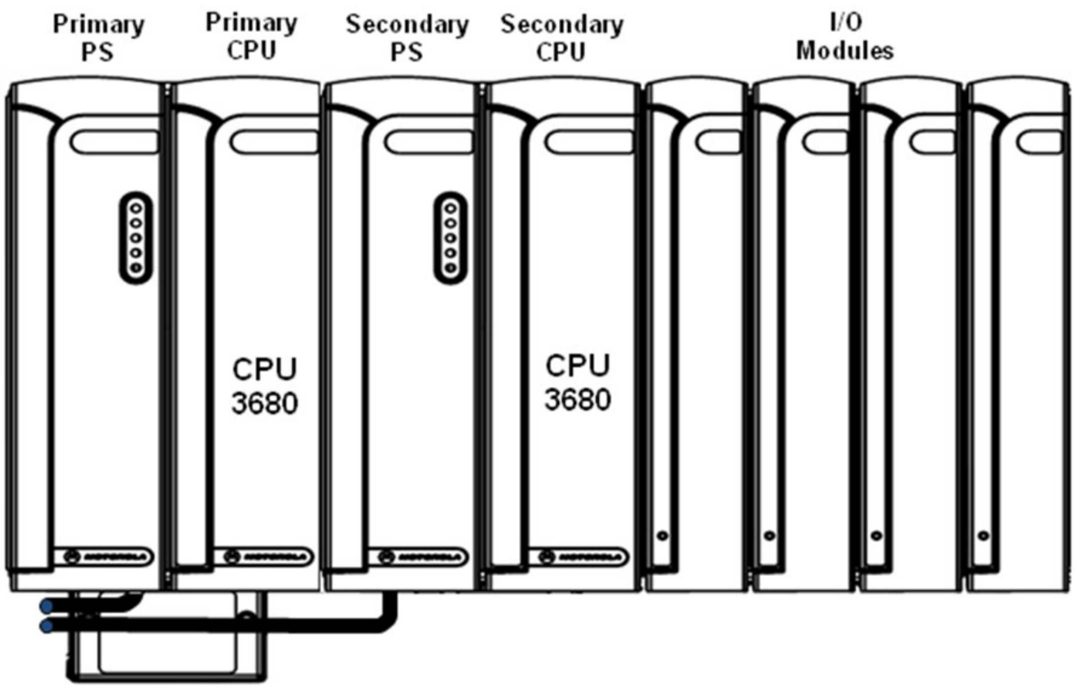


Figure 4-1 ACE3600 Redundant CPU and Power Supply Configuration

Redundant CPU

Redundant CPU Behavior

- When redundant CPUs (ACE3680 only) are used, the CPU in the leftmost CPU slot (to the right of the first power supply) is the primary CPU. The CPU in the rightmost CPU slot is the secondary CPU. The primary CPU communicates with the primary power supply and the secondary CPU communicates with the secondary power supply (if the secondary power supply exists.)

- When the RTU is powered up, the primary CPU becomes the active CPU (monitors/controls the I/O modules.) If the primary CPU does not exist or has failed, the secondary CPU becomes the active CPU. If the primary exists and is working, the secondary CPU becomes the standby CPU (which continuously monitors the active CPU.) On the active CPU, the I1 ACTV LED is lit.

- If the standby CPU detects that the active CPU has failed, it automatically becomes the active CPU. When the faulty CPU is repaired or replaced with a working CPU, the newly installed CPU becomes the standby CPU.

- If both the primary and secondary CPUs exist and are working, a forced active CPU switchover can be performed from the STS Hardware Test by deactivating the active CPU, after which the standby CPU will become active. A forced switch can also be performed from a ‘C’ user application.

- If both the primary and secondary CPUs exist and are working, hot swap of the CPU is supported. Note that if the active CPU is removed, the standby CPU automatically becomes active. Redundancy switchover occurs within 10 msec of loss of active CPU control (i.e. if the active CPU does not reset the watchdog for more than 5 msec, if the active CPU resets, or if the active CPU is removed from its slot.)

The ACE3680 CPUs include an internal Ethernet 100 Mb/s port used for redundancy only. This interconnection (via motherboard) between the active and standby CPUs enables the active CPU to continuously synchronize the standby CPU's database and clock.

I/O expansion is supported by the redundant CPU configuration. For details, see the ACE3600 System Planner, but are limited to 12 expansion frames. The primary CPU and secondary CPU must be connected to the I/O expansion LAN switch(es). The I/O expansion frames must be connected to the LAN switch (note that with redundant CPUs even a single I/O expansion frame requires an expansion LAN switch module.) I/O modules in the main rack are not affected by redundancy switchover. I/O modules in expansion racks enter PDV/KLV mode until connection is established with the new active CPU (between 5-15 seconds.)

For information on using the Redundant CPU feature, see the RTU Redundancy section of the ACE3600 STS Advanced Features manual.

Redundant Power Supply

Redundant power supplies are used to ensure a continuous supply of the required RTU voltages, in the event that one power supply fails. When one of the power supplies fails, the user application program can sense it and send an alarm to the control center. Both the primary and secondary power supplies must be of the same type. Only the primary power supply is configured in the STS and the configuration is duplicated to the secondary power supply.

The primary CPU (leftmost CPU slot) communicates with the primary power supply, and the secondary CPU (rightmost CPU slot) communicates with the secondary power supply.

Redundant Power Supply Behavior

- The primary power supply always has priority. The secondary power supply takes over if the primary is absent, or if the power level of the primary is lower than the secondary by 0.4V.

- When power returns to the primary power supply, the secondary gives up the control.

Note: The power to the motherboard is initially provided by the primary power supply. In a system with I/O expansion and redundant power supplies, the power distribution does not support the redundancy. Therefore it is recommended that each expansion frame use its own power supply (not an expansion power supply).

Redundant CPU and Power Supply RTU Configuration

By default, the Redundant CPU and Power Supply option includes a special frame/ motherboard designed for dual power supply, dual CPU, and four I/O slots. In addition, two CPU3680 modules, one 12V power supply and one blank power supply module are provided.

It is possible to replace the default single 12V power supply with any of the power supply options (AC, AC with charger, 18-72 VDC, etc.) except the low-tier power supply.

It is also possible to order a secondary 12V power supply (dual power supply configuration) instead of the blank power supply module. In this case a dual power cable connecting between the Power junction box and the two power supplies will be provided too.

Note: The redundant power supply configuration can be ordered with the 12V power supply only. Redundant CPUs and power supplies are supported for CPU 3680 firmware version 15.0 and above, and by power supply version V2.75 and above only (manufactured from April 2011.) Use the STS Hardware Test to view the power supply version. The power supply version is not upgradeable.

For additional redundant power supply configurations, see the ACE3600 System Planner.