Owner's Manual

ACE3600 RTU

6802979C35-A

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
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
HW	Hardware
IEC	International Electrotechnical Commission
IO (I/O)	Inputs Outputs
IP	Internet Protocol
IPGW	MOSCAD 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	Particle 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
USB	Universal Serial Bus
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)
- Relay Digital Outputs (DO)
- Analog Inputs (AI)
- Mixed I/O

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 (ACE3640 models)

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, Duo-binary 9600)
- 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

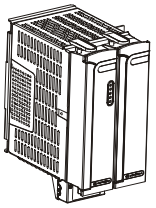
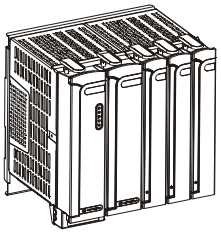
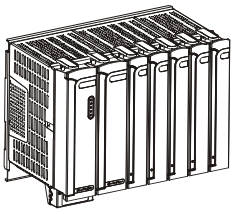
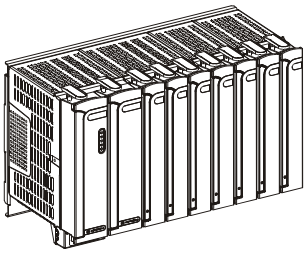
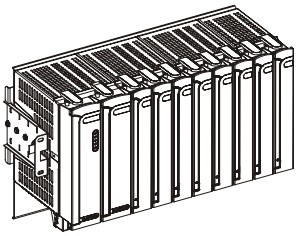
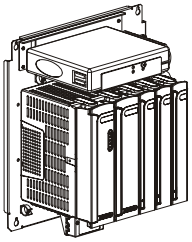
A frame can be mounted on the wall or installed in a 19” rack or customer enclosure. For more information, see the Installation chapter below

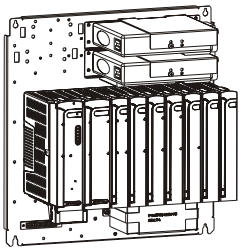
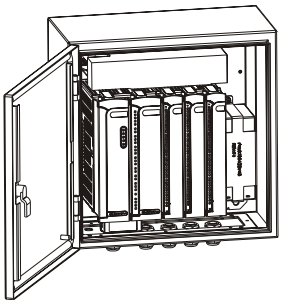
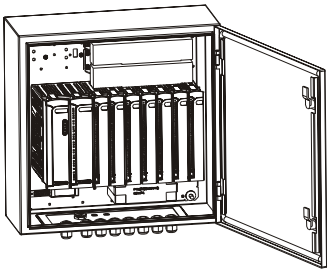
The ACE3600 frame can include wide or narrow plastic slot units:

- 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 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.	
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.	
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.	
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.	
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 up to 2 radios; up to four plastic boxes.	
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 3 I/Os, 1 mobile/portable radio, 1 plastic interface 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 plastic interface box, up to 2 mobile/portable radios, 6.5 or 10 Ah Lead-Acid backup battery	
Small NEMA 4X/IP65 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 plastic interface box, 6.5 Ah Lead-Acid backup battery	
Large metal NEMA 4X/IP65 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 plastic interface 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 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.
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.

Component	Function	Notes
Radio installation kit	Mechanical support and cables that enable installation of radio.	See Radio Types and Installation Kits chapter.
RS485 Junction Box	Enables connection of up to 5 devices to the RS485 port on the CPU (2W multi-drop).	See Connecting Power and Ground in the Installation chapter.
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.

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.

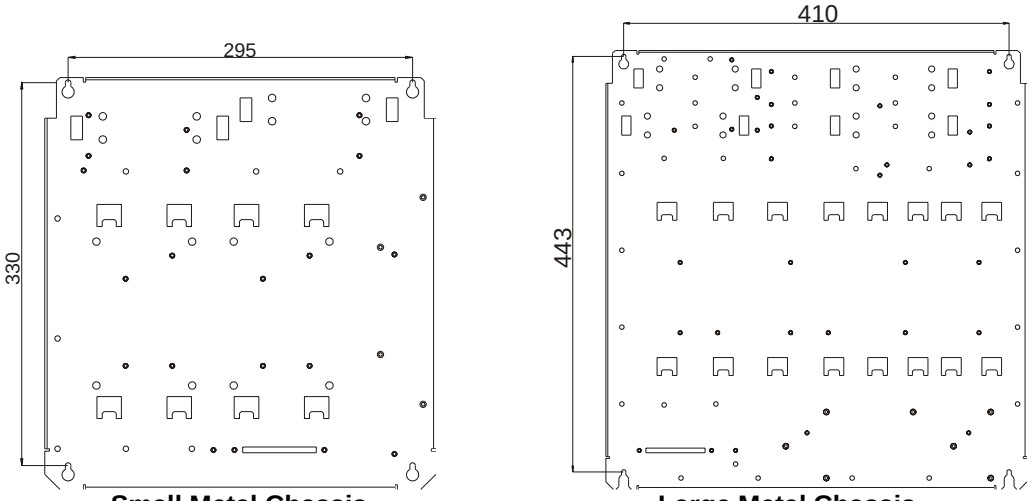
After removing the power supply module, allow the metal parts to cool down before servicing the unit.

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 **Large Metal Chassis**

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

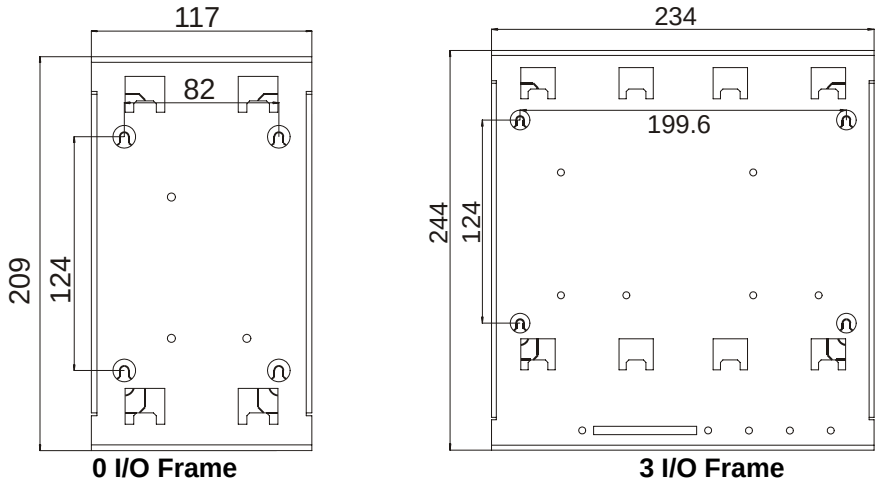


Figure 2-2. No I/O and 3 I/O Frame Installation Dimensions and Screw Holes for Installation

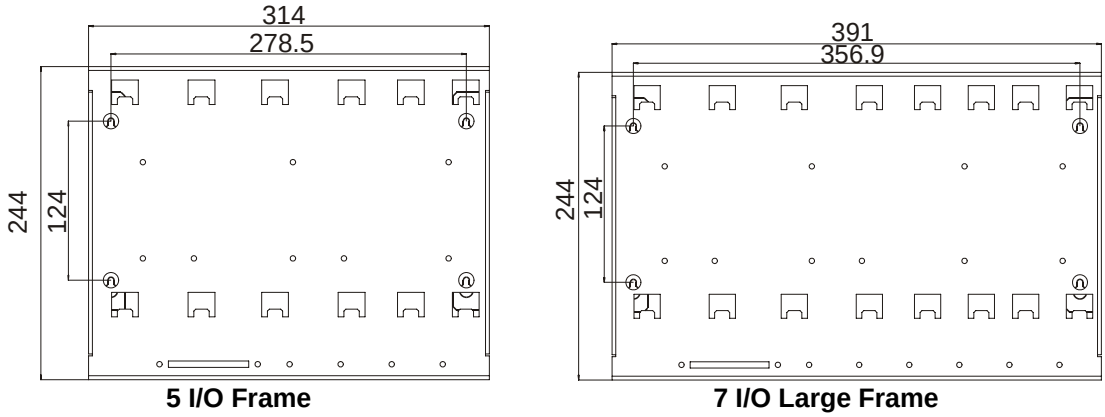


Figure 2-3. 5 I/O and 7 I/O Frame Installation Dimensions and Screw Holes for Installation

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") frames.

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 and Figure 2-2.

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 in a 19" rack.

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) Press the small metal bracket into the slot of the larger bracket. See Figure 2-4.

2) Secure the two brackets together with two M5 screws (supplied), according to the desired depth of the unit on the rack. See Figure 2-4.

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

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

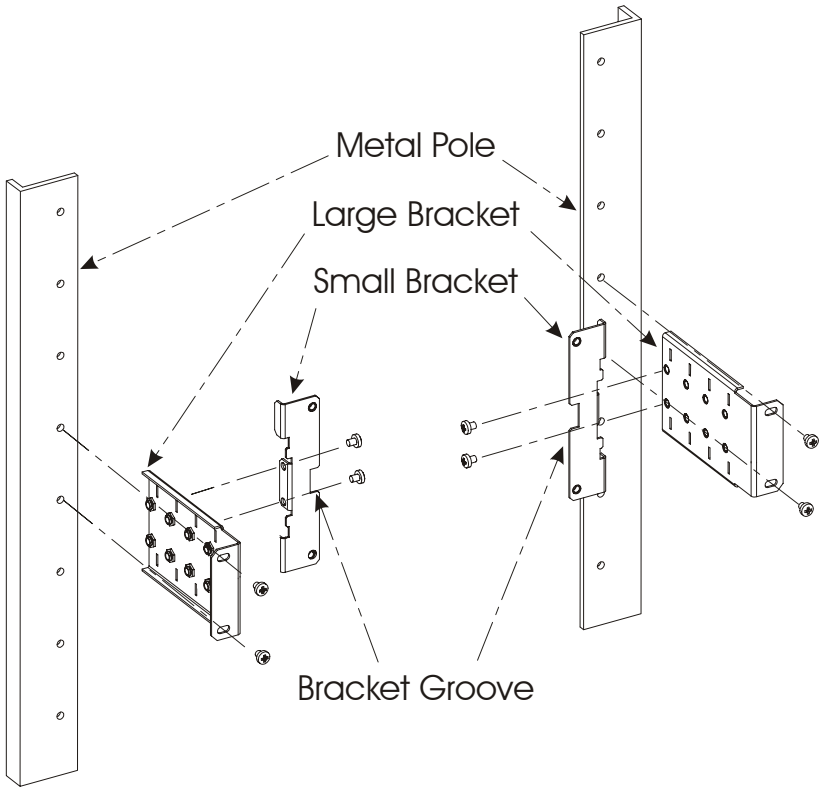


Figure 2-4. Installation of Brackets for 19" Rack Units

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.

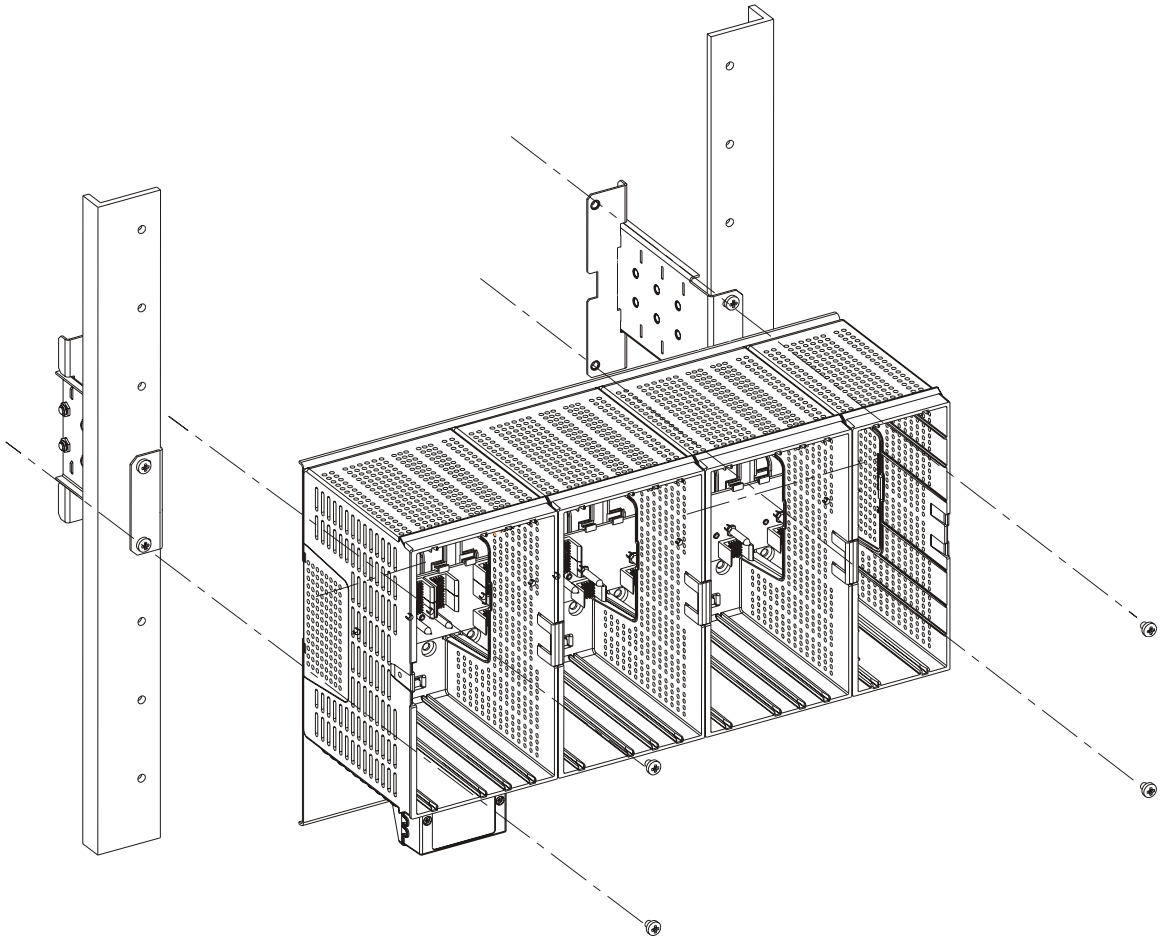


Figure 2-5. Installation of ACE3600 RTU 19" Rack- Exploded View

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 2-6.)

7) Using two supplied M5 (X6) screws and a 16 cm (6.3") long screwdriver, from inside the slot secure the 19" metal chassis to the small bracket. Repeat on the second side. See Figure 2-5.

8) Replace any removed modules to their slots.

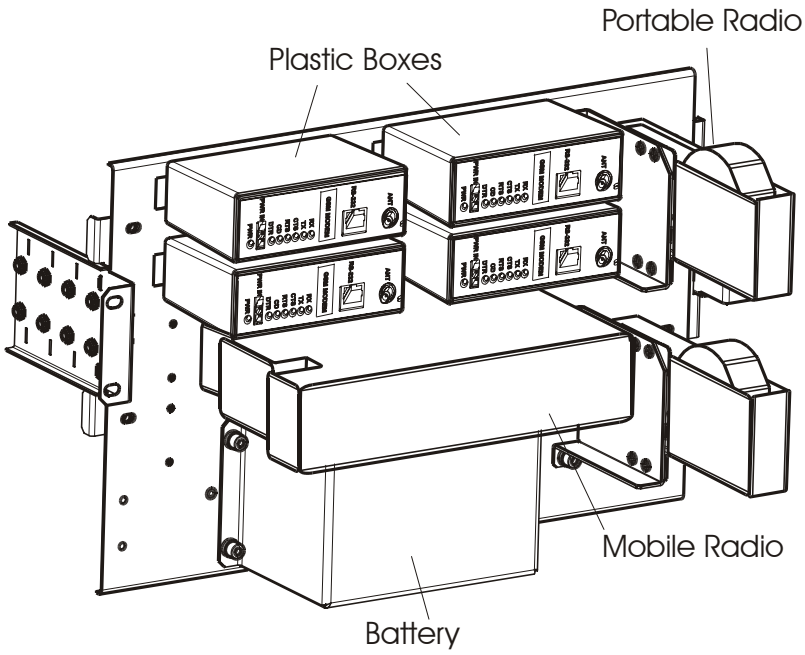


Figure 2-6 Installation of ACE3600 RTU 19" Rack Accessories - General View

Mounting the ACE3600 8 I/O Frame on a Wall

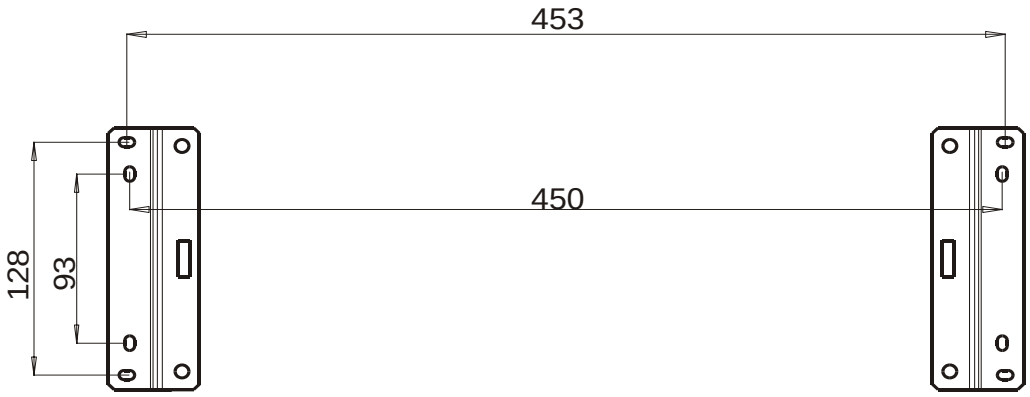


Figure 2-7. RTU Metal Chassis Installation Dimensions

Procedure 2-3 How to Mount the RTU 19" Metal Chassis 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 rack.

2) Drill four holes into the wall at the horizontal and vertical distances shown in Figure 2-7.

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 2 teeth of the metal chassis hook onto the groove of the brackets. (See Figure 2-8.)

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

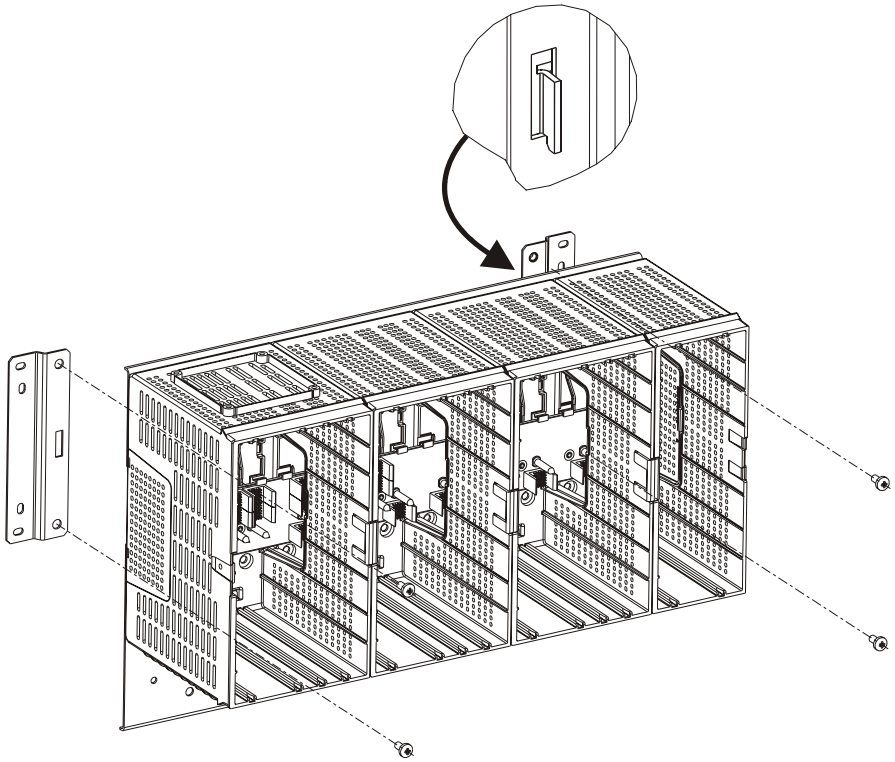


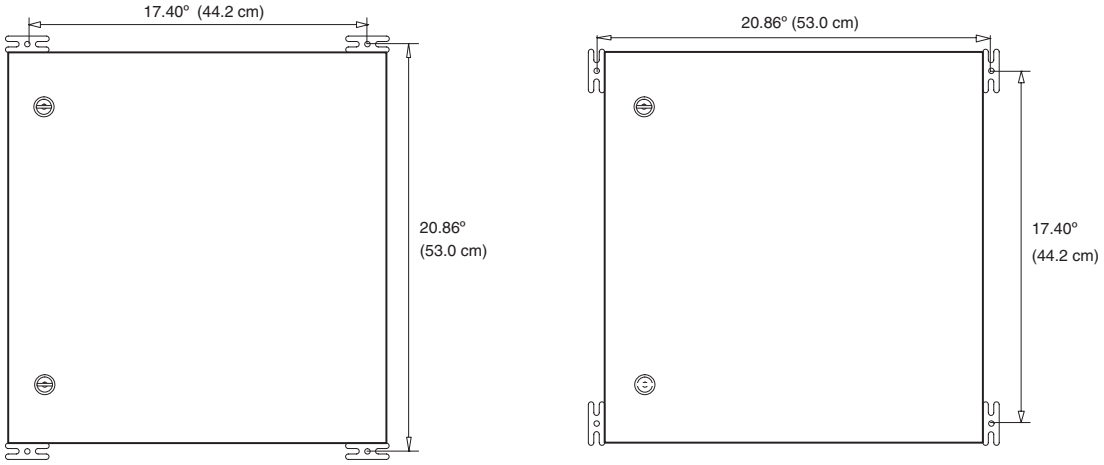
Figure 2-8. RTU Metal Chassis Installation

Mounting the ACE3600 NEMA4 Housing on a Wall

The following screw mount installation procedure should be used to install ACE3600 frames in NEMA4 housing on a wall.

For convenient installation of the ACE3600 RTU with the NEMA4 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 2-9 through Figure 2-11). Figure 2-9 and Figure 2-10 show the distances between the bracket holes.



Horizontal Bracket Installation **Vertical Bracket Installation**

Figure 2-9. Large NEMA 4 Housing - Installation Dimensions

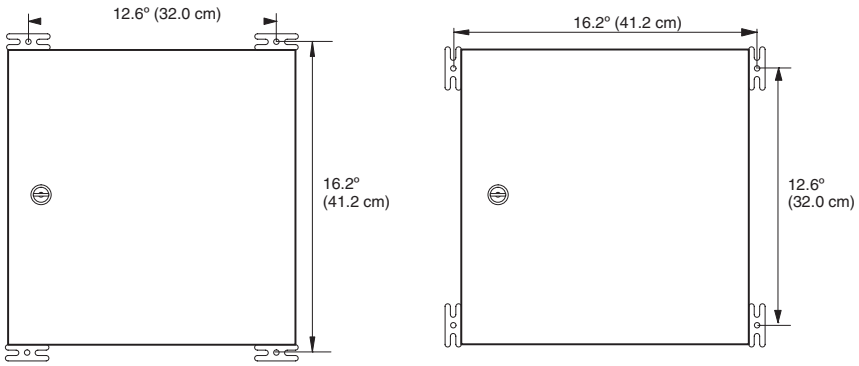


Figure 2-10. Small NEMA 4 Housing - Installation Dimensions

Procedure 2-4 How to Mount the RTU NEMA4 Housing

1) Drill four holes in the wall at the horizontal and vertical distances shown in Figure 2-9 (for the large housing) and in Figure 2-10 (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 2-11.

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 2-11.

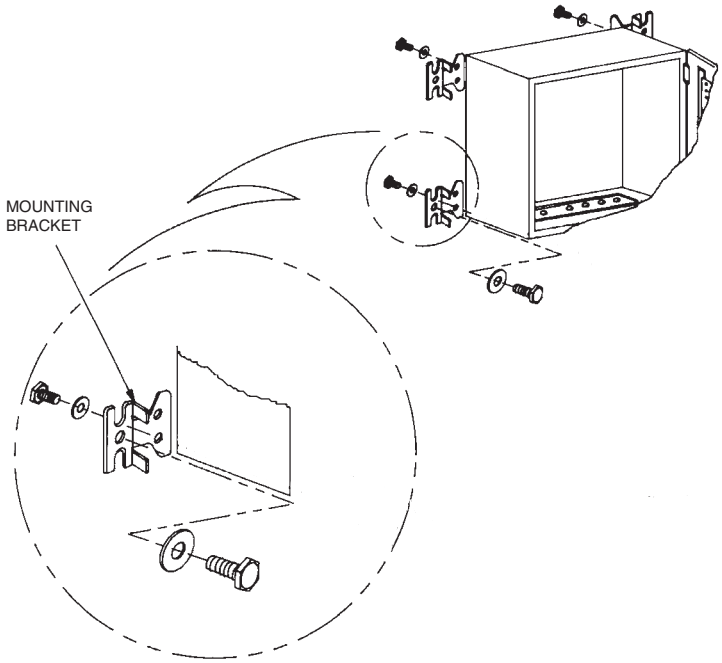


Figure 2-11. Mounting the NEMA 4 Housing

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.

WARNING

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 over voltage 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 2-12 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 2-12 below.)
  Anchor point 2 for all units with housing (other than No I/O Slots) is in the housing power cable gland. (See Figure 2-16 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 2-13 below.)

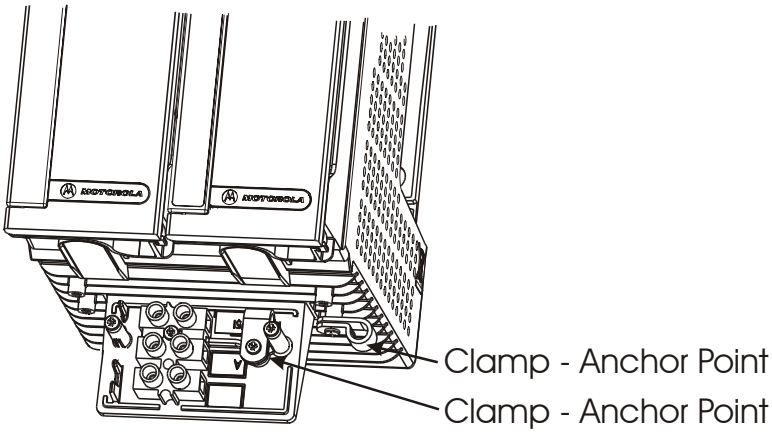


Figure 2-12. RTU on No I/O Frame – Cable Anchor Points 1 and 2

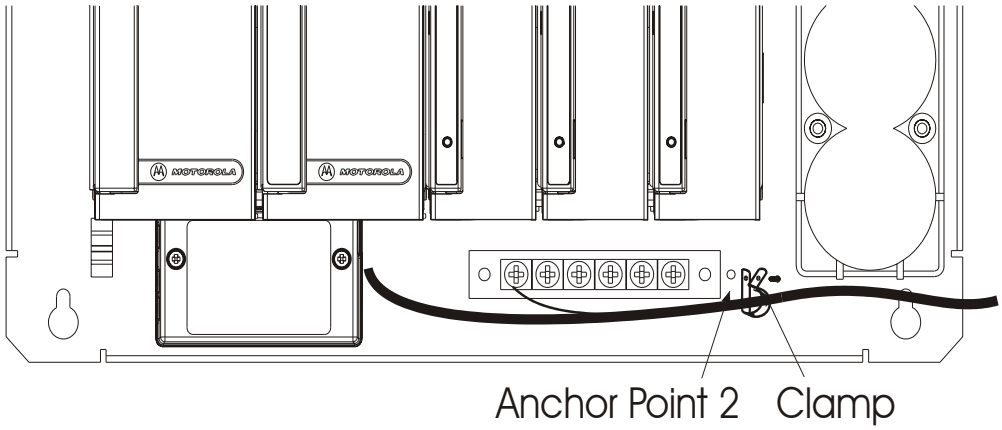


Figure 2-13. RTU on Metal Chassis – Cable Anchor Point 2

Procedure 2-5 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). Figure 2-14 and Figure 2-15.

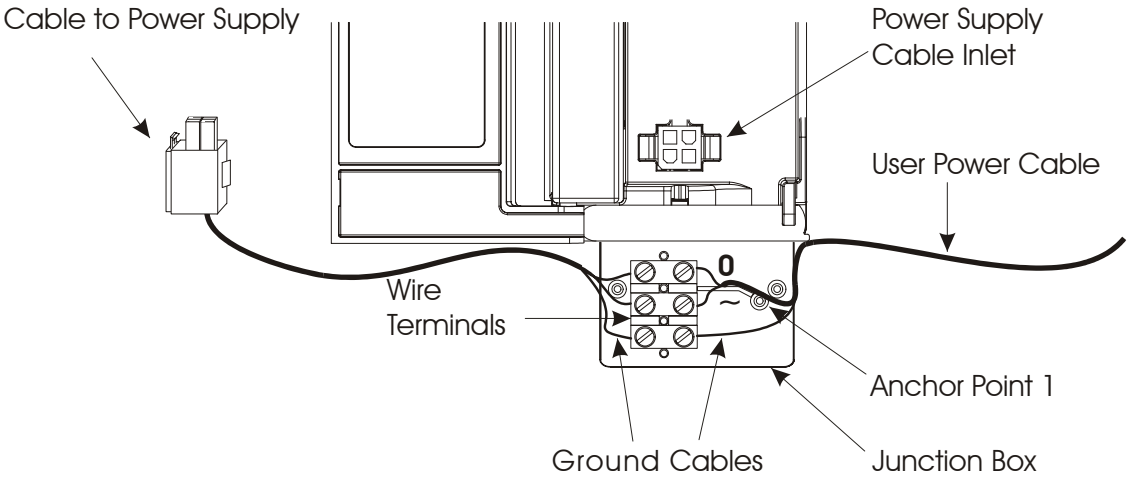


Figure 2-14. RTU Power and Ground Connections - No I/O Frame Installation

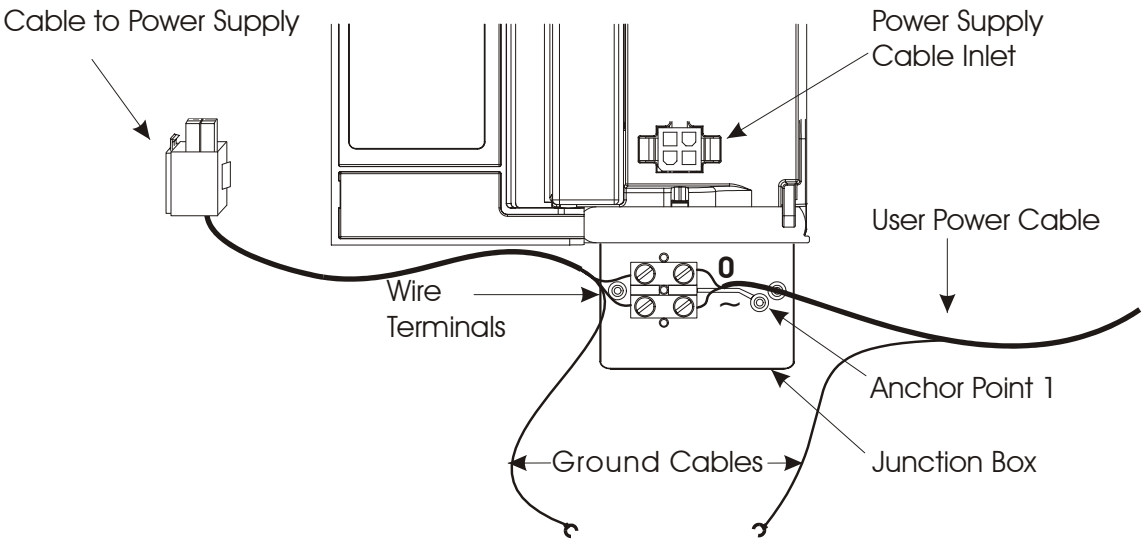


Figure 2-15. RTU Power and Ground Connections – All Other Installations

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).

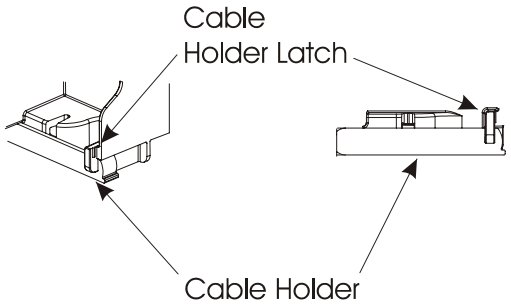
6) Close the second clamp and screw it onto the anchor point near the grounding strip (or on the bottom of the plastic to the right of the junction box in case of the No I/O Slots frame.)

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 (3089004V64 for DC, 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 2-6 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 2-16.)

3) Place the nut into the same hole from inside the housing and screw the nut onto the cable gland. (See Figure 2-16.)

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 2-16.)

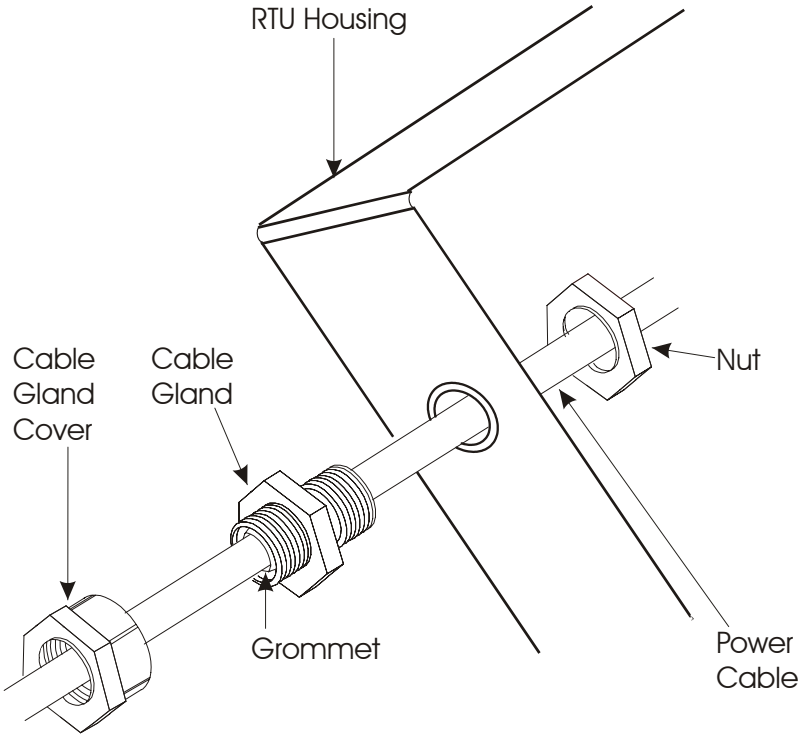


Figure 2-16. RTU in NEMA4 Housing – Cable Gland Anchor Point 2

5) Attach the wires of the user cable, according to labels (~/0 for AC and +/- for DC.) See Figure 2-14 and Figure 2-15. 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 (3089004V64 for DC, 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 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 2-7 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 10V DC, DO NOT use the battery and replace it with a charged battery that measures at least 10V DC.

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

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

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.

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 (10.5-16V) - provided by default with the ACE3600 RTU
- DC power supply (18-72V)
- DC power supply (18-72V) with battery charger
- AC power supply- 85-264V
- AC power supply- 85-264V with battery charger

Common characteristics of all power supply modules:

- On/Off switch on the front panel
- Controlled auxiliary voltage outputs
- Heat convection cooling (no need for fans)
- Short protection outputs
- Over heating protection
- The module function is monitored by the CPU module.
- Status LEDs in the front panel
- PS located on the leftmost slot of the frame
- Input current protection fuse
- Controlled power line enables centralized disabling of Electrically Energized relay outputs in selectable DO modules.

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

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

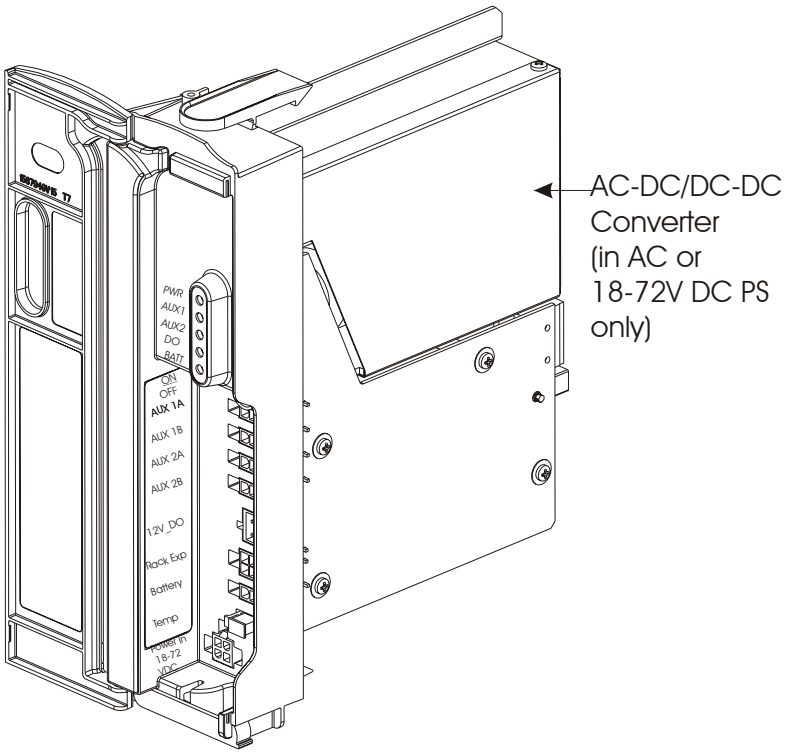


Figure 3-1 ACE3600 Power Supply – General View

CAUTION

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.

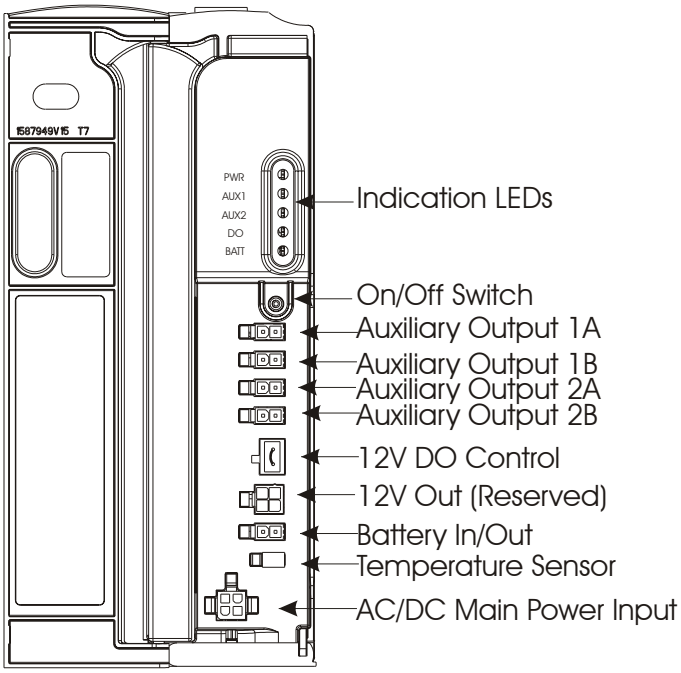


Figure 3-2 ACE3600 Power Supply – Front Panel

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 includes the following connectors.

Connector Name	Description	Notes
Auxiliary Output 1A	13.2V DC (±20%) User controlled power output. Short protected.	This output is used for powering radios, modems, etc. The output can be switched ON/OFF either by user application program or by a 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
Auxiliary Output 2A	DC Power Output Selectable/programmable 3.3 to 9V DC or 13.2V DC±20%. User controlled power output. Short protected.	This output is used for powering radios, modems, etc. The output can be set by the user with the STS configuration function. The output can be switched ON/OFF either by a hardware test or by 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. If both 2A and 2B are ON, they must have the same output level. The voltage levels of AUX2A and AUX2B are the same.

Connector Name	Description	Notes
12V DO Control	Control input that enables centralized disabling of Electrically Energized (EE)/ Magnetically Latched (ML) relay outputs in selectable DO modules. Input open = Relays are disabled. 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.
12V Out	(Reserved)	Pin 1- PGND Pin 2- 12V DO Pin 3- GND Pin 4- MAIN (12V)
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.

LEDs

The front panel of the power supply module 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 - the LED is lit in Red. When there is no AC or DC input - 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
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. Battery tests are performed using the STS Hardware Test function or the user application program.

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.

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.

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 discharges the battery for 20 seconds and then measures the output. 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 (-30˚ to 60˚C),
4. If the battery is not fully loaded.

Connecting the Power Supply to a Power Source

The power supply can be connected to an AC or DC power source.

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

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

Power Supply Detailed Specifications

Input voltage	DC 10.5-16 V (Default) DC18-72 V DC (option V251) 18-72 V DC with 12V smart battery charger (option V367) 85-264 V AC , 50/60 Hz (option V346) 85-264 V AC, 50/60 Hz with 12V smart battery charger (option V261)
Total Power	Maximum 60 W continuous; maximum 105 W peak @ 25% duty cycle
Outputs	To motherboard (for CPU and I/O modules): 13.2 V DC ±20%, max. 8A AUX1A/AUX1B user connectors: 13.2V D ±20% C, max.8A AUX2A/AUX2B: 13.2 V DC ±20%, max. 8A or 3.3 / 5 / 7.5 / 9 V DC ±10%, max. 2.5A
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.
Diagnostics LEDs	Status LED for: input voltage, AUX1 and AUX2 outputs voltages and battery
Efficiency	DC: 80% typical, 76% typical (full load) AC: 80% typical @230 V AC, 76% typical @115 V AC (full load)
Inrush Current	DC: 10 A maximum, for 2 mSec. Max, cold start at 25°C AC: 25 A maximum, for 2 mSec. Max, cold start at 25°C
Power Factor	AC: 0.98 typical at 230 V AC, 0.99 typical at 115 V AC
Input Protection	Internal Line Fuse, replaceable
Protection	Overload and Short Circuit, automatic recovery
Over-Voltage Protection	Automatic outputs shut down
Insulation	DC: Input to case: 500 V DC, input to output 500 V DC AC: 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	DC 10.5-16 V: Approx. 0.43Kg (0.95 Lb), All others : Approx. 1kg (2.2 lb)

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 -40º to +70ºC. 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.

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.

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.)

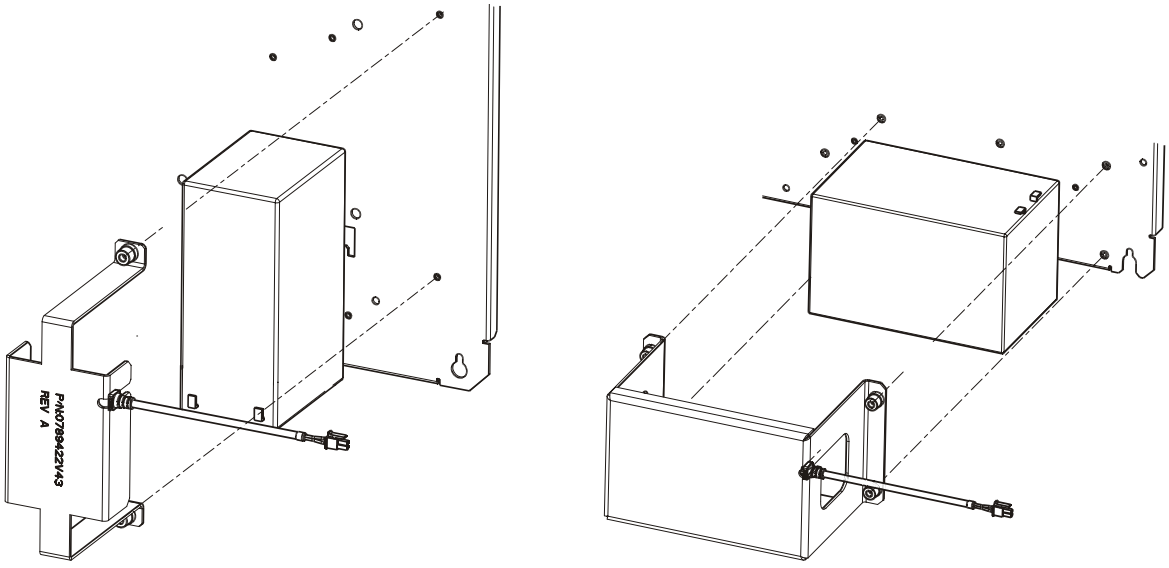


Figure 3-3 Backup Batteries – Exploded View

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 10V 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

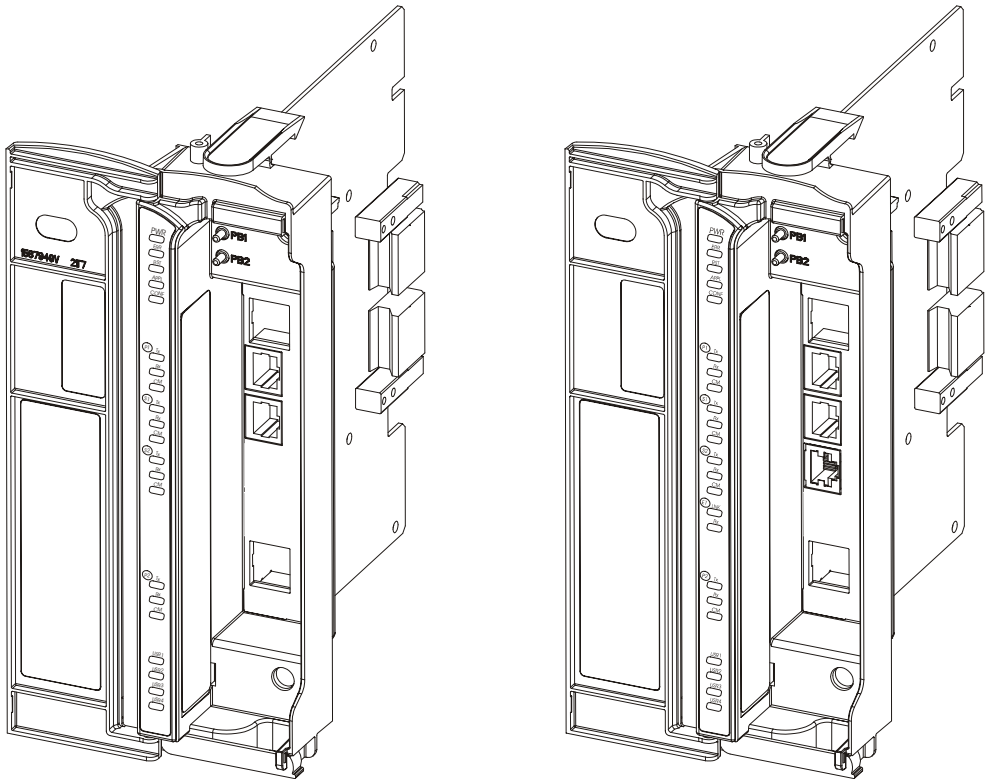
General Description

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.)

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



Model 3610 **Model 3640**

Figure 4-1 ACE3600 CPU – General View

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.

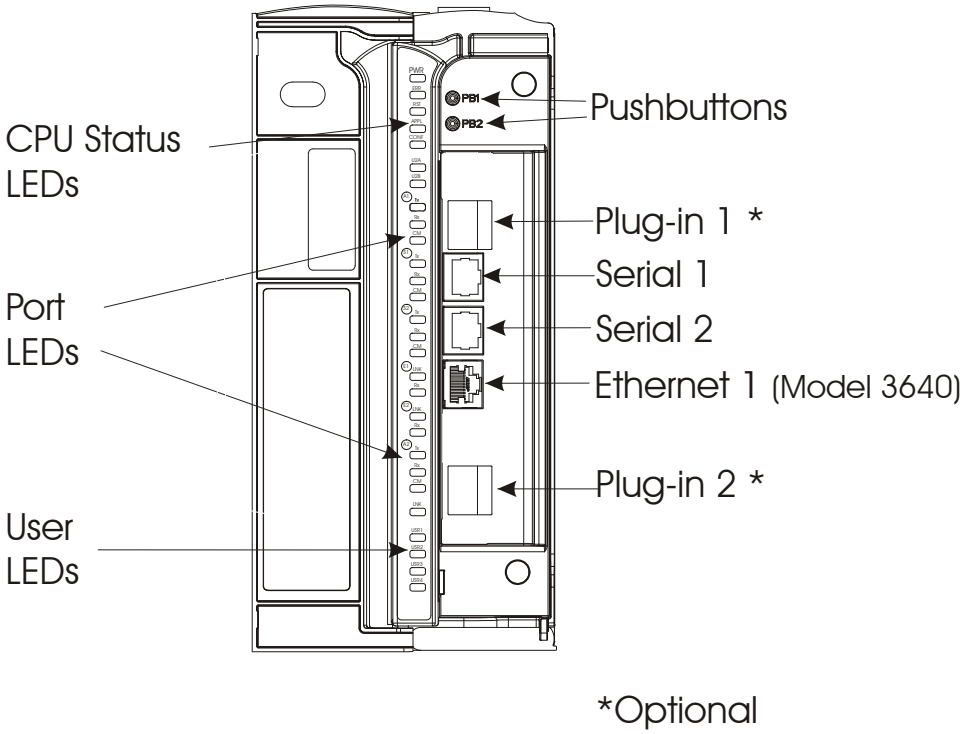


Figure 4-2 ACE3600 CPU (Model 3610/3640) – Front Panel

Front Panel

Communication Ports

The CPU module includes several communication ports:

<u>On Board ports:</u>

- Serial 1 (SI1) – RS232/RS485 serial port (configurable)
- Serial 2 (SI2) – RS232 serial port
- Eth1 (E1) - 10/100BaseT Ethernet port (CPU 3640 only)

<u>Plug-in ports bays, where different types of ports can be installed:</u>

- 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 Module Specifications below. For information on the cables and connectors, see Appendix C.

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 4-3 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. The battery will retain the SRAM data for a minimum of accumulated 90 days without power. When the SRAM option is not used, the Lithium battery will keep the Real Time Clock running for two years.

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

Table 4-1 ACE3600 CPU Memory

	Model 3610	Model 3640
Flash memory	16 Mb	16 Mb
SDRAM memory:	32 Mb	32 Mb
User FLASH:	3 Mb	3 Mb
User SDRAM:	10 Mb	10 Mb
SRAM Plug-In	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.

The lithium battery is capable of preserving the data stored in the SRAM and RTC for 90 days (accumulated time of power off.)

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 10.5 to 16 V DC. During power-up, the processor performs fast memory tests, initiates the RTU and starts the user program (if it was downloaded). The end of 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 5-6 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.

Power-down

When the voltage provided to the CPU module drops below 9.6VDC, the CPU will shut down in an orderly fashion.

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 warning, orange indicates an error and red indicates a critical 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 Test and is also available to the user application program. For more information, see the Hardware Test section or the Creating a User Application 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.

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

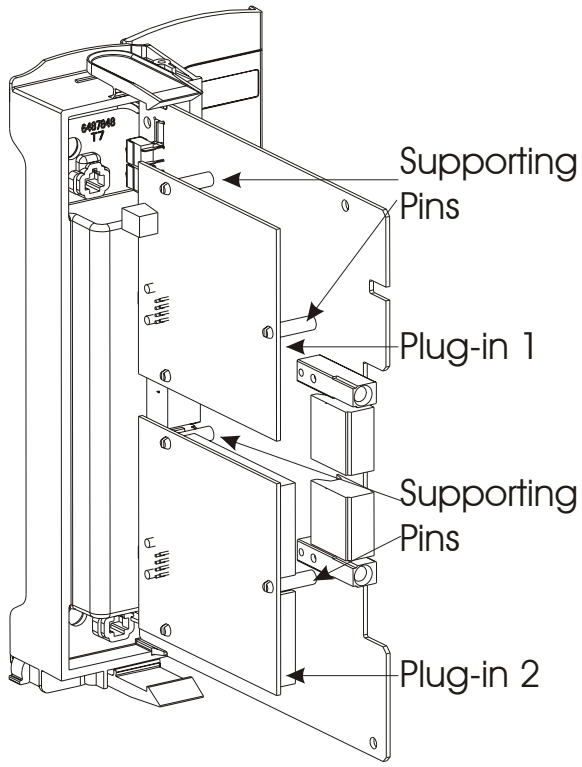


Figure 4-3 Plug-In Port in CPU Module

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 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.

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

Future option

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.

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

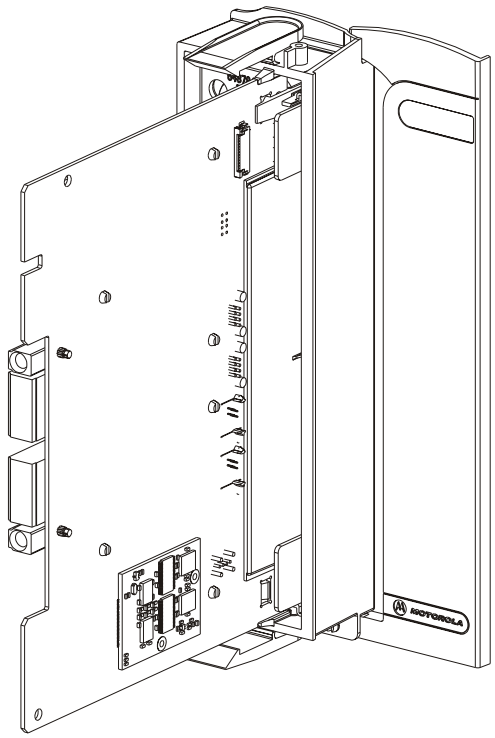


Figure 4-4 SRAM Expansion in CPU Module

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

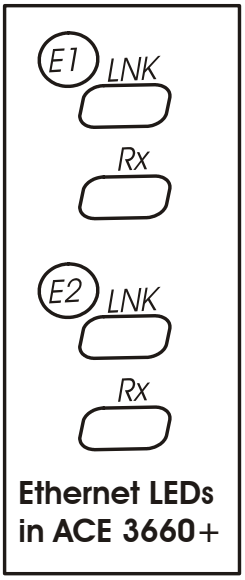
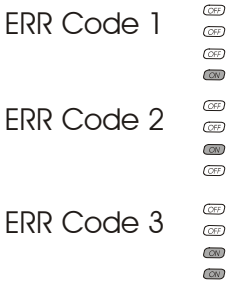
1) Remove the CPU module from the RTU.
2) Remove the cover from the connector marked P12 on the CPU board.
3) Place the plug-in SRAM memory card with the connector facing the panel. Carefully insert the plug-in board connector into the connector on the CPU board.
4) Secure the memory card to the CPU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

Table 4-2 ACE3600 Pushbutton Functionality

Scenario	Trigger	Action
LEDs Test	During run-time, press PB1 for five consecutive seconds.	All the LEDS on the CPU and I/O modules will be lit for up to 20 seconds 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 more than five consecutive seconds.	All the LEDS on the CPU and I/O modules will be lit for up to 20 seconds. (The LEDs lit time can be configured in the RTU configuration using the STS.)

Scenario	Trigger	Action
RAM Test	During startup, press PB1.  **Ethernet LEDs in ACE 3660+**	A detailed memory test of SDRAM and SRAM plug-in is performed. - At the beginning of the RAM test, the four Ethernet LEDs (see left) will blink three times. During the RAM test, the LEDs will 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) and the four LEDs will blink seven times. The fail error code will be displayed on the LEDs, in binary code, as follows:  (where OFF LED = '0'; continuously lit LED = '1'. The highest LED is the most significant.) -ERR Code 1 = Error in Flash -ERR Code 2 = Error in SDRAM -ERR Code 3 = Error in SRAM - To exit/abort the RAM test in the middle, restart the RTU (see RTU Restart above.)
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.

CPU LEDs Behavior

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

Table 4-3 ACE3600 CPU LEDs Behavior

LED Name	Description	Status
PWR	Power LED Bicolor LED (Red, Green)	Flashing Red – Power exists; power-up in progress. Green – Power exists; power-up completed. Red – Failure on power-up. (AC fail, Bat Error, etc.) Orange - Battery test in progress.
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.
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.
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

LED Name	Description	Status
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 RX	Ethernet Port 1 (receive) Green LED	ON – Receiving Data
E1 LNK	Ethernet Port 1 (link) Green LED	ON – Network Connected
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)
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.

CPU 3610/CPU 3640 Module Specifications

Microprocessor	Freescale – Power PC II MPC8720, 32-bit, extended communication capability, DMA and floating point calculation support
Microprocessor Clock	200 MHz
User Memory	FLASH: 3 MB DRAM: 10MB Optional plug-in SRAM: 4 MB
Real-Time Clock	Full calendar with leap year support (year, month, day, hours, minutes, seconds, milliseconds). Time drift: max. 2.5 Seconds per day (when power is on)
SRAM and RTC Retention	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 460.8 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 2.4 kb/s, DFM 4.8 kb/s and Duo-binary 9.6 kb/s - RS232, Sync/Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS485, multi-drop 2-Wire up to 460.8 kb/s - Ethernet 10/100 Mb/s
Plug-In Port 2	Supports the following Plug-In ports: - Radio Modem (General Radio Interface) DPSK 1.2 kb/s, FSK 2.4 kb/s, DFM 4.8 kb/s and Duo-binary 9.6 kb/s - RS232, Sync/Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS485, multi-drop 2-Wire up to 460.8 kb/s - Ethernet 10 Mb/s
Ethernet Port 1	10/100 Mb/s, (on CPU 3640 only)
LEDs Display	4 CPU diagnostics LEDS, Port status LEDs and user application LEDs
Operating Voltage	9.6-16 V DC (from the motherboard connector)
Power Consumption	Max. 4.2 W (300 mA @ 14 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. 0.38 Kg (0.84 Lb)

Specifications subject to change without notice.

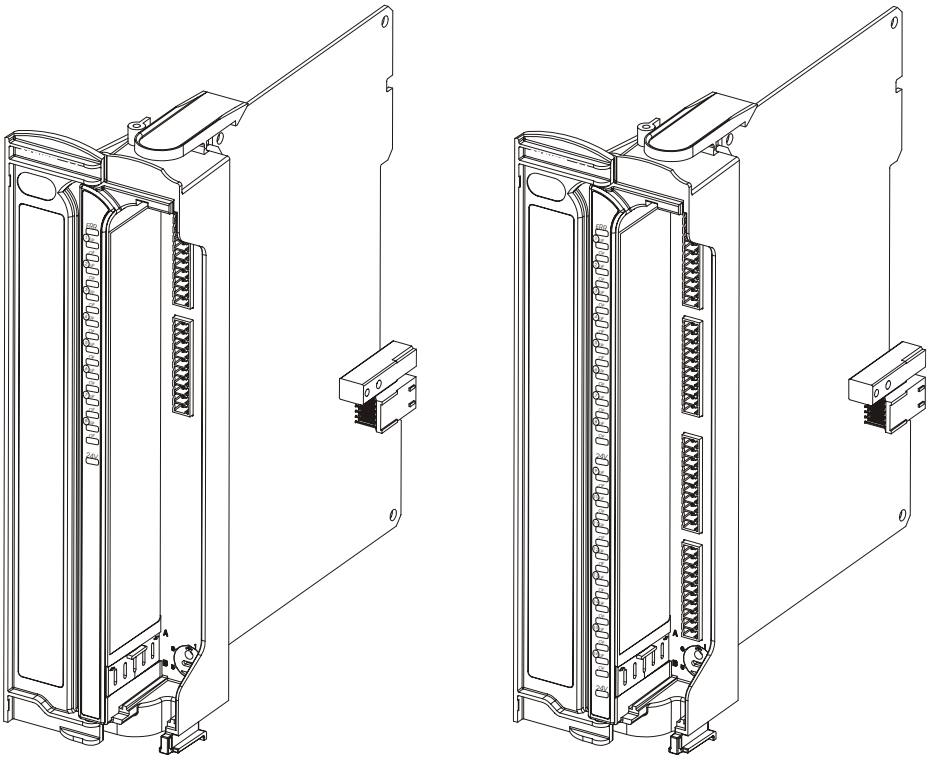
I/O MODULES

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.

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 Expanded 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.

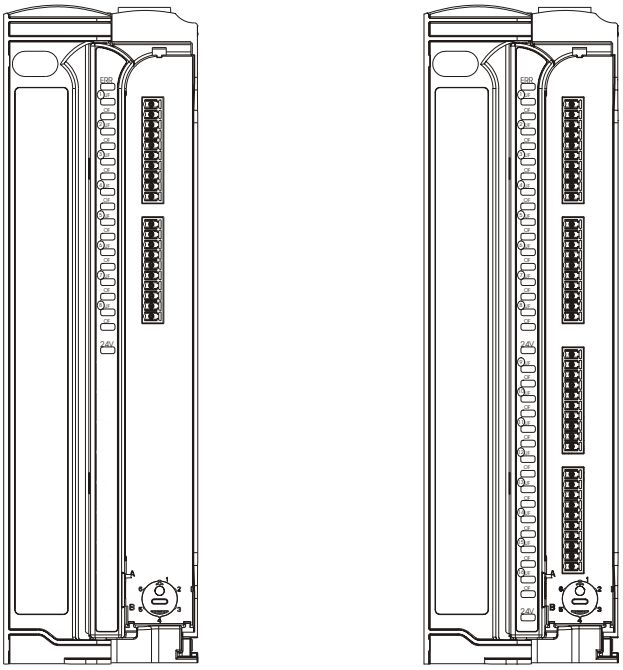


Figure 5-2 ACE3600 I/O Module – Front Panel (without TB Holder)

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).

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

TB connectors have 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. An optional TB extractor is available for easy removal of TBs.

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. Extractor 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). The TB holder kit does not include a cable.

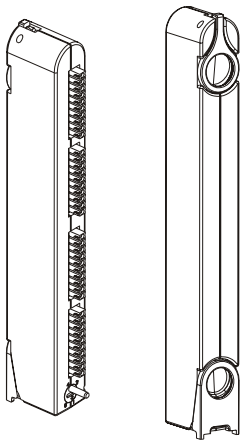


Figure 5-3 Terminal Block (TB) Holder-Front and Back View

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 5-4)

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 extractor 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 extractor handle at the bottom of the TB holder.

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

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

Figure 5-4 provides an exploded view of the TB holder assembly.

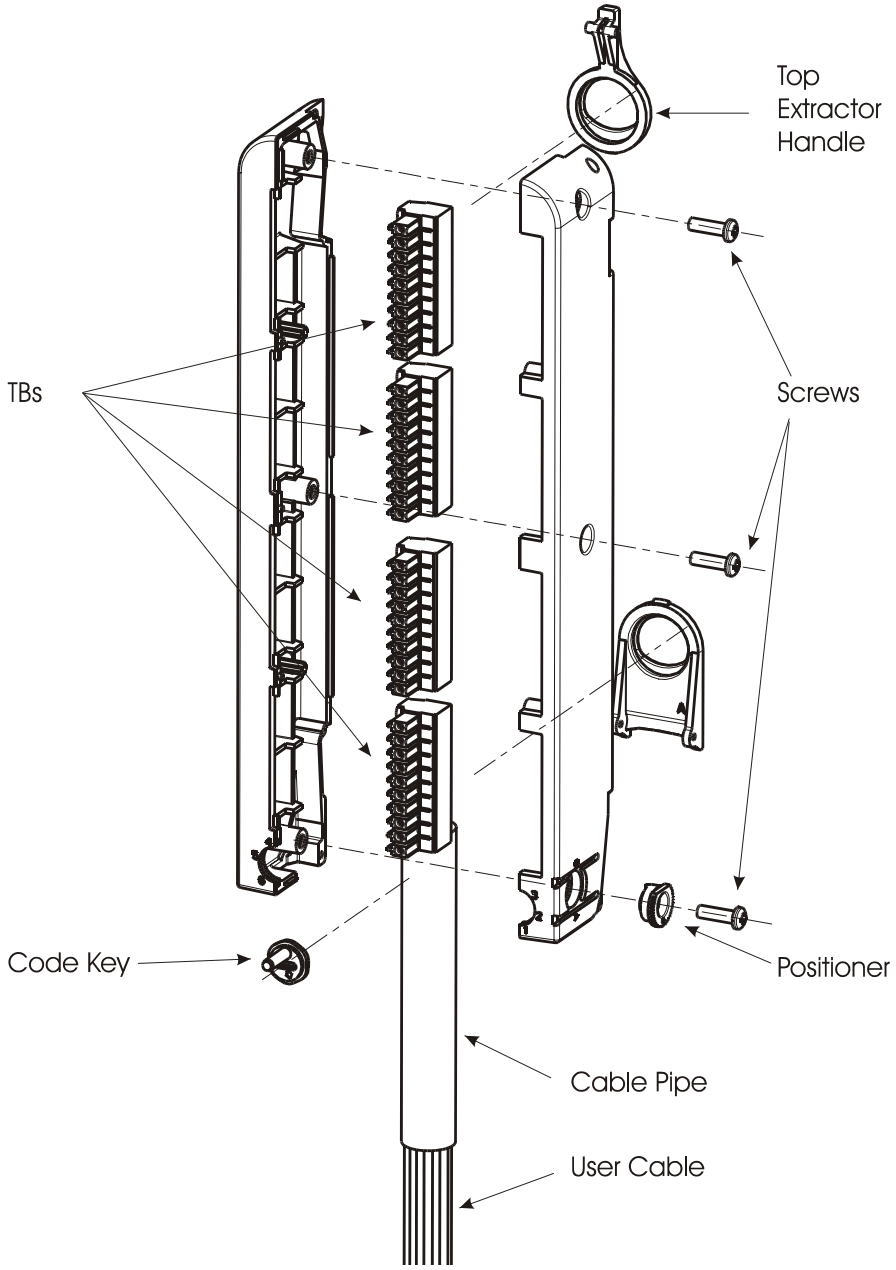


Figure 5-4 Terminal Block (TB) Holder Assembly – Exploded View with Coding

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 5-5)

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

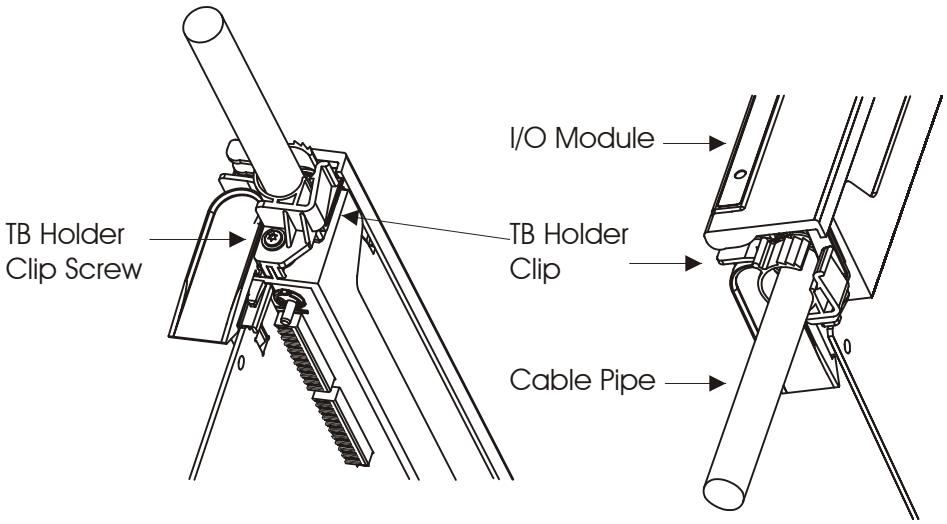


Figure 5-5 I/O Module with Terminal Block (TB) Holder Clip

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 screw driver, set the code key pin to a number from 1 to 6.

5) On the I/O module, using a 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 5-6), fitting the code key pin into the code key.

8) If the extractor handles are extended, push them inwards, against the TB holder (see Figure 5-6.)

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 5-5.

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/extractor handles outward away from the module and pull on the handles.

Figure 5-6 provides a general view of the TB holder and an I/O module.

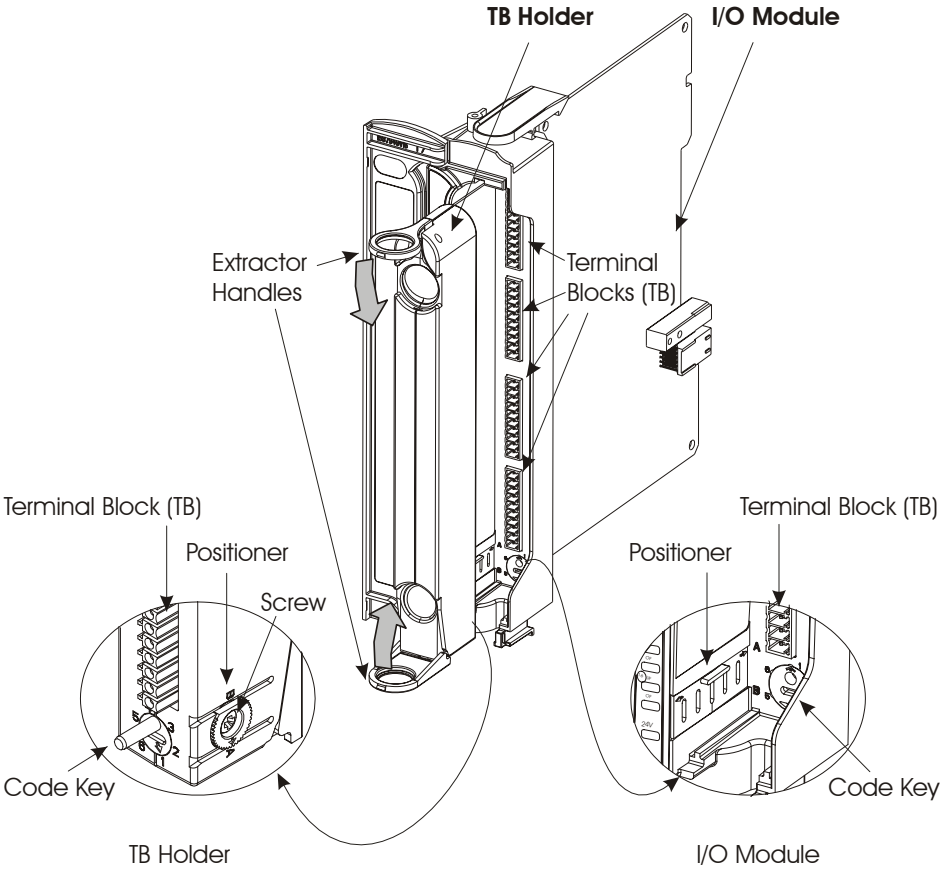


Figure 5-6 Terminal Block (TB) Holder on I/O Module – General View with Coding

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 Rack

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 rack, see the Replacing an I/O Module section of the Break-Fix Procedures chapter below.

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

Future option

Up to two 24V DC floating plug-in power supplies can be added to certain I/O modules, as detailed in the table below.

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

Module Type	Number of Power Supplies
32 DI	2
16 DI	1
16 AI	1
8 AI	1
Mixed I/O	1

The plug-in power supply is ordered separately.

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:

1) Put the plastic screw(s) in the hole(s) from under the board.

2) Screw the plastic spacer(s) onto the plastic screw(s).

3) Place the plug-in over the spacer(s).

4) Screw the top plastic screw into the spacer(s) 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 350mA. The power supply plug-in can be turned ON/OFF via the user application program or Hardware Test utility.

Figure 5-7 provides a general view of an I/O module with one plug-in.

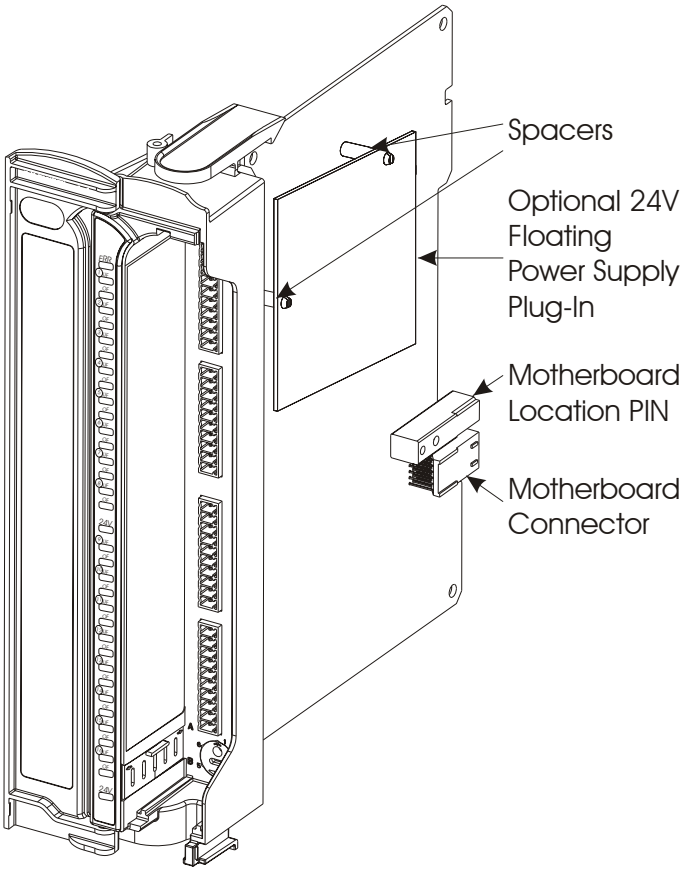


Figure 5-7 ACE3600 I/O Module – General View

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

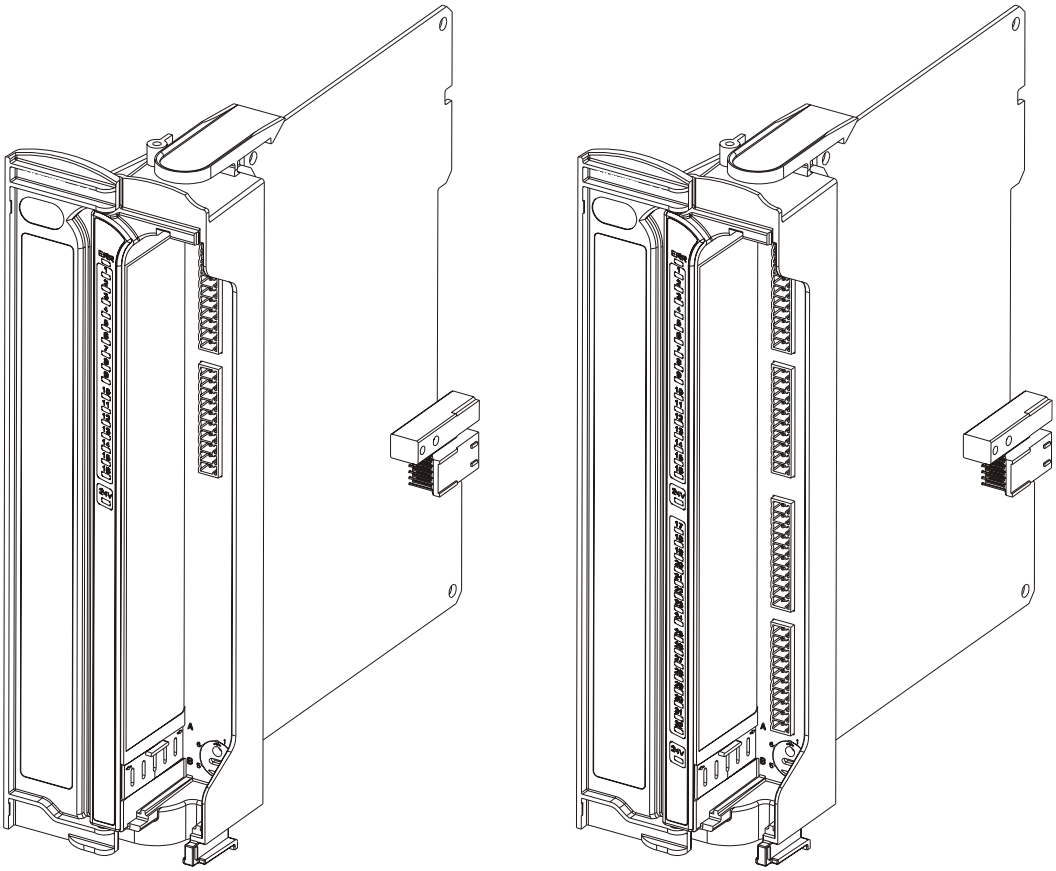
Two types of voltage ("wet") inputs are supported, IEC 61131-2 Type II compliant inputs and 24V "MOSCAD compatible" inputs. In the 32 DI module, the first 20 inputs can function as fast counters. In the 16 DI module, all inputs can function as fast counters. A counter's maximum rate is dependent on the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

All the inputs are optically isolated. The DI modules 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, TB holder, and other common I/O module features, see the I/O Modules chapter above.

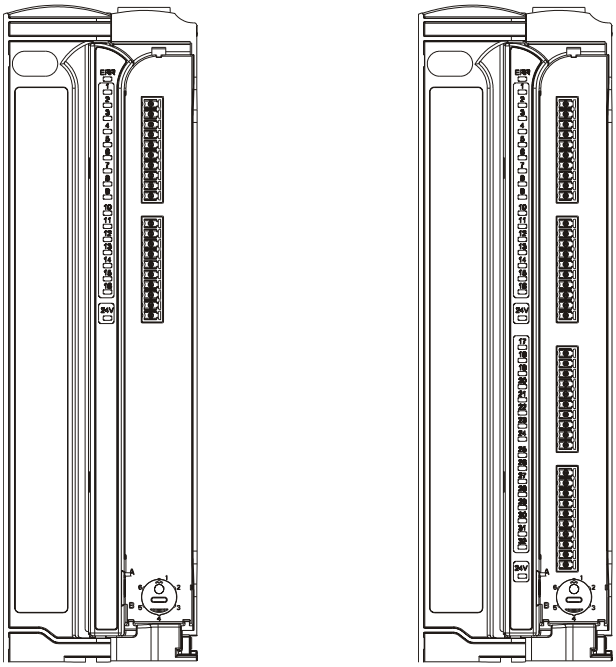
Figure 6-1 provides a general view of the ACE3600 DI module.



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.

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 (10 mS)	Module	STS site configuration; 'C' User Program
Counter Filter (DC)	0-255 (x 0.05 mS)	20 (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

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.

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

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.

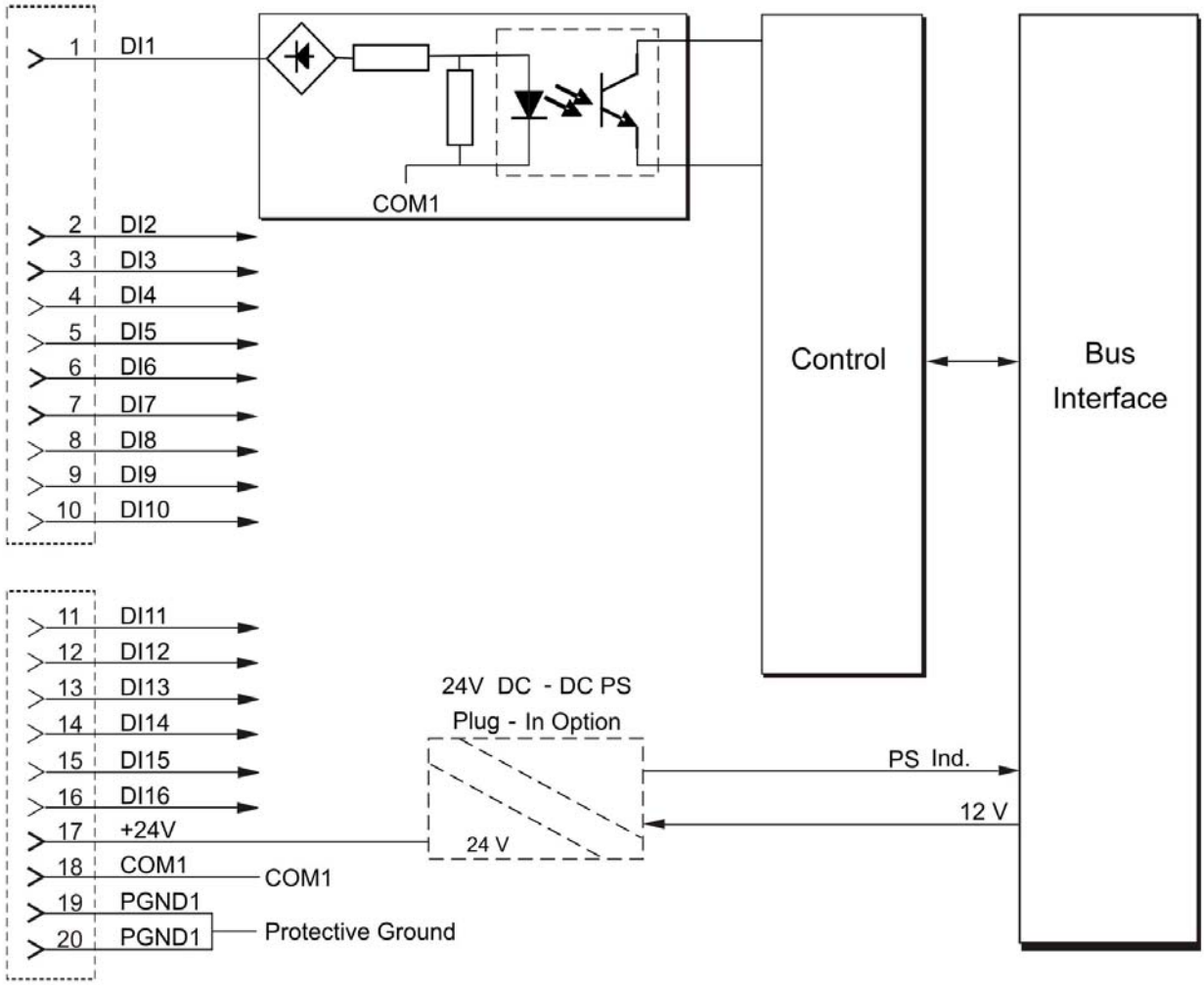
The DI module can be diagnosed and monitored using the STS Hardware Test utility. This test verifies that the module is operational, presents the module configuration and shows the actual value of each input. It is also possible to change the input filter setup temporarily for the duration of the Hardware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

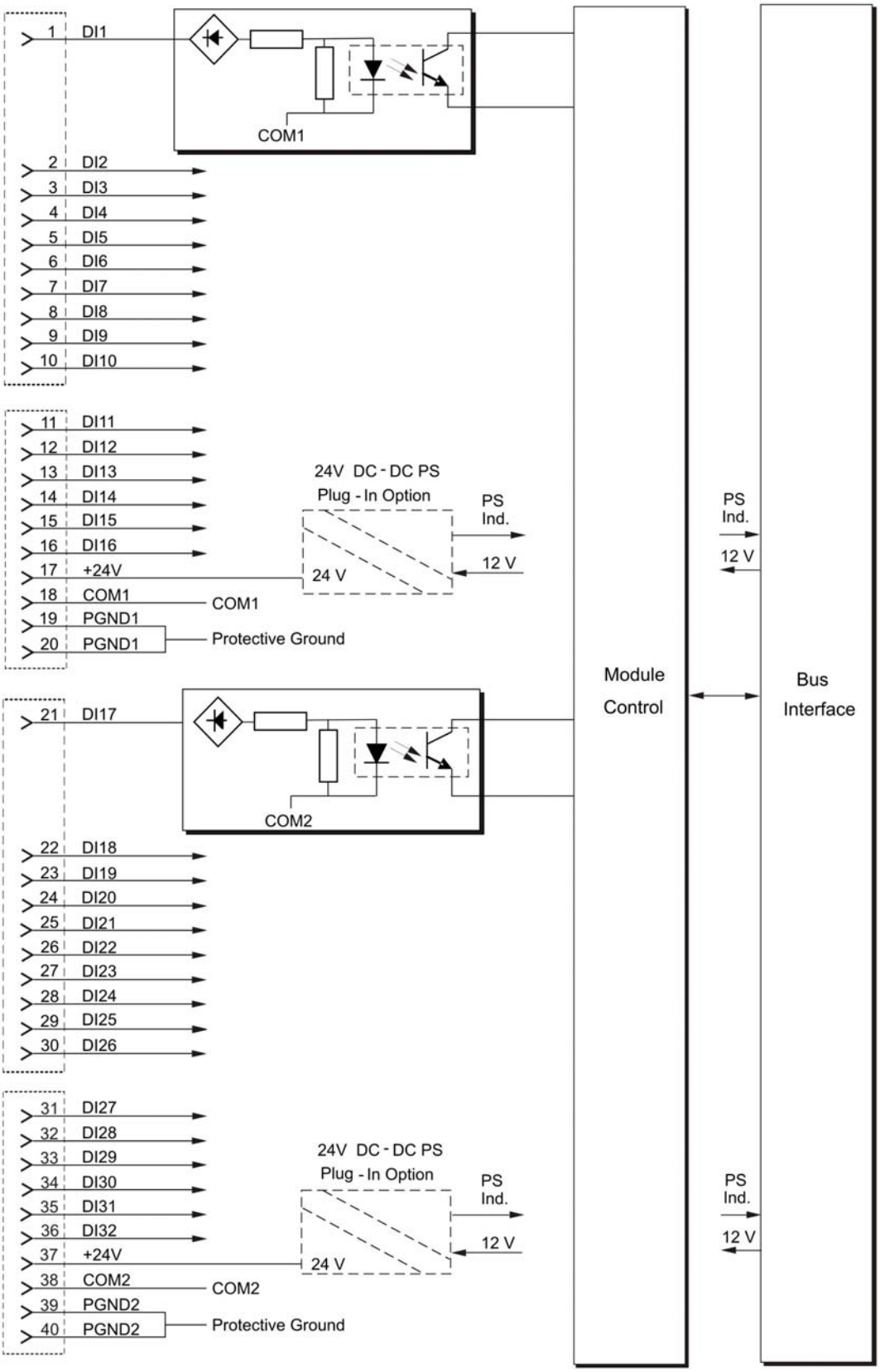
For details on configuring the DI modules, see the Site Configuration section, and the Application Programming section of the STS User Guide.

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
24V DC - DC PS
Plug - In Option
24 V
PS Ind.
12 V
COM1
Protective Ground
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 COM2
39 PGND2
40 PGND2
24V DC - DC PS
Plug - In Option
24 V
PS Ind.
12 V
COM2
Protective Ground
Module Control
Bus Interface
PS Ind.
12 V
PS Ind.
12 V

DI Module Specifications

16/32 DI FAST 24V Module	
Total Number of Inputs	16 DI (Option V265); 32 DI (Option V379)
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
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, -9 to -30 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. 2.5 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 counter)
24 V DC Output	Supports optional isolated 24 V/0.35 A plug-in "Wetting" Power Supply (one in 16 DI, two in 32 DI)
Diagnostics LEDs	Status LED per each input, 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 TB Holder connector, 26 AWG wires
Module Replacement	Hot swap replacement – module extraction / insertion under voltage
Input Isolation	2.5 kV DC/AC between input and module logic per IEC255-5
Input Insulation	Insulation resistance 100 MΩ @ 500 V DC, Insulation impulse 5 kV per IEC255-5
Operating Voltage	10.5-15.5 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	16 DI: 0.1 W Typical, 0.32 W Max. (all LEDs on) 32 DI: 0.1 W Typical, 0.45 W Max. (all LEDs on) (Not including Plug-in 24 V Power Supply power consumption)
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 Module	
Total Number of Inputs	16 DI (Option V117) 32 DI (Option V959)
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 40 μS
Max. DC Input Voltage	Max. ±40 V DC (relative to input common)
"ON" DC Voltage Range	+11 to +30 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/0.35 A plug-in "Wetting" Power Supply (one in 16 DI, two in 32 DI)
Diagnostics LEDs	Status LED per each input, module error LED
User Connection	2 or 4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable and TB Holder	20 or 40 Wires Cable with Terminal Block Holder connector, 26 AWG wires
Module Replacement	Hot swap replacement – module extraction / insertion under voltage
Input Isolation	2.5 kV DC/AC between input and module logic per IEC255-5
Input Insulation	Insulation resistance 100 MΩ @ 500 V DC, Insulation impulse 5 kV per IEC255-5
Operating Voltage	10.5-15.5 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	16 DI: 0.1 W Typical, 0.32 W Max. (all LEDs on) 32 DI: 0.1 W Typical, 0.45 W Max. (all LEDs on) (Not including Plug-in 24V Power Supply power consumption)
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.

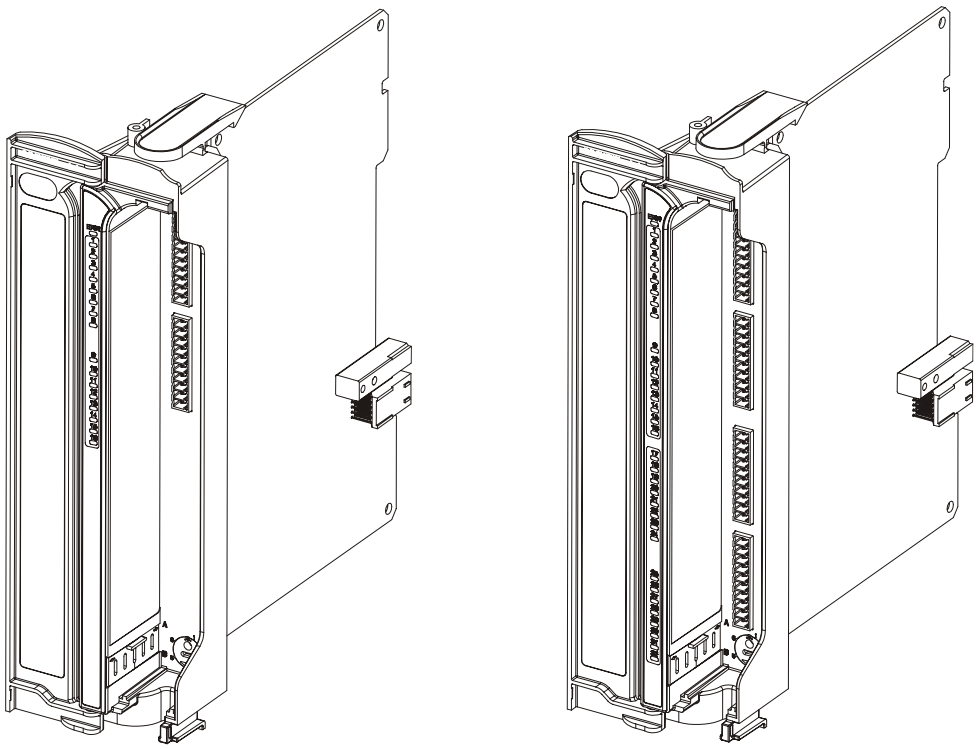
The following Digital Output/Digital Input (DO/DI) FET modules are available.

- 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, TB holder, and other common I/O module features, see the I/O Modules chapter above.

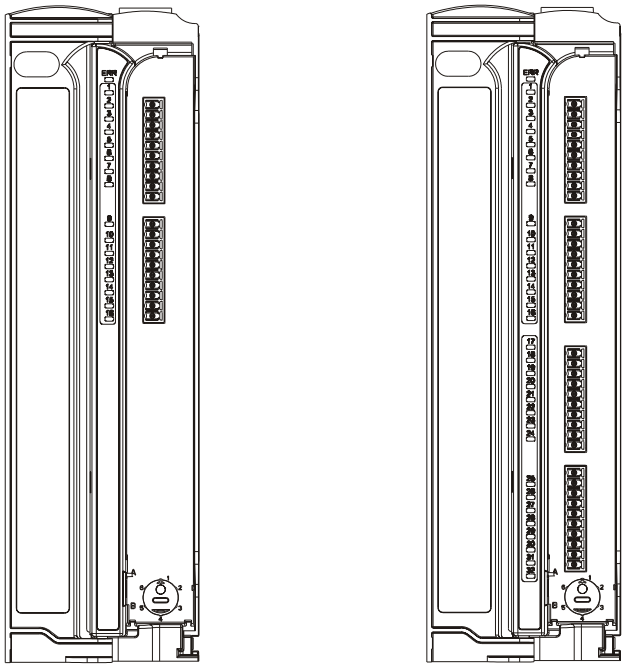
Figure 7-1 provides a general view of the ACE3600 DO/DI FET module.



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

Figure 7-1 ACE3600 DO/DI FET Module – General View

Figure 7-2 provides a detailed view of the ACE3600 DO/DI FET module front panel.



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

Figure 7-2 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.

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 7-1 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 (10 mS)	Module	RTU configuration; 'C' Program
DI Counter Filter	0-255 (x 0.05 mS)	20 (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.

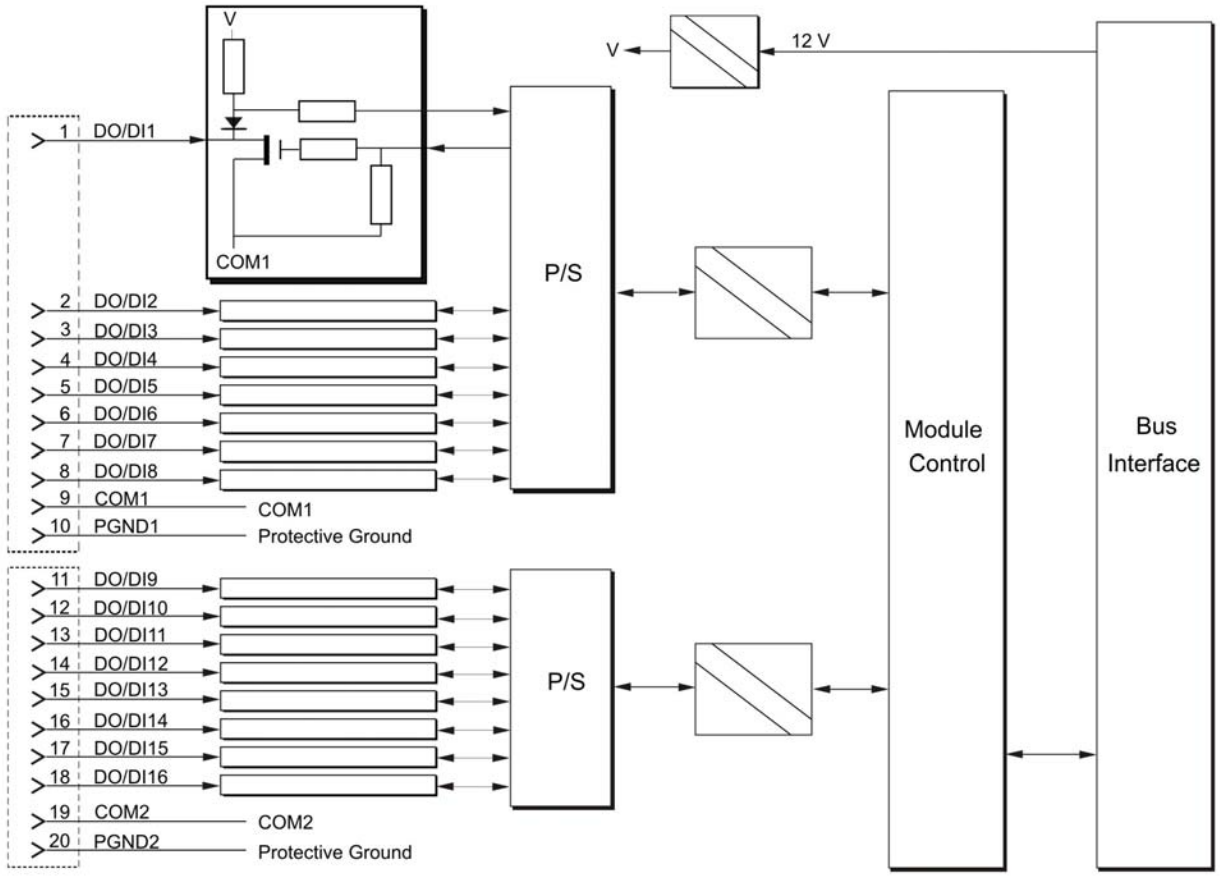
The DO/DI module can be diagnosed and monitored using the STS Hardware Test utility. The Hardware Test verifies that the module is operational, presents the module configuration and

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.

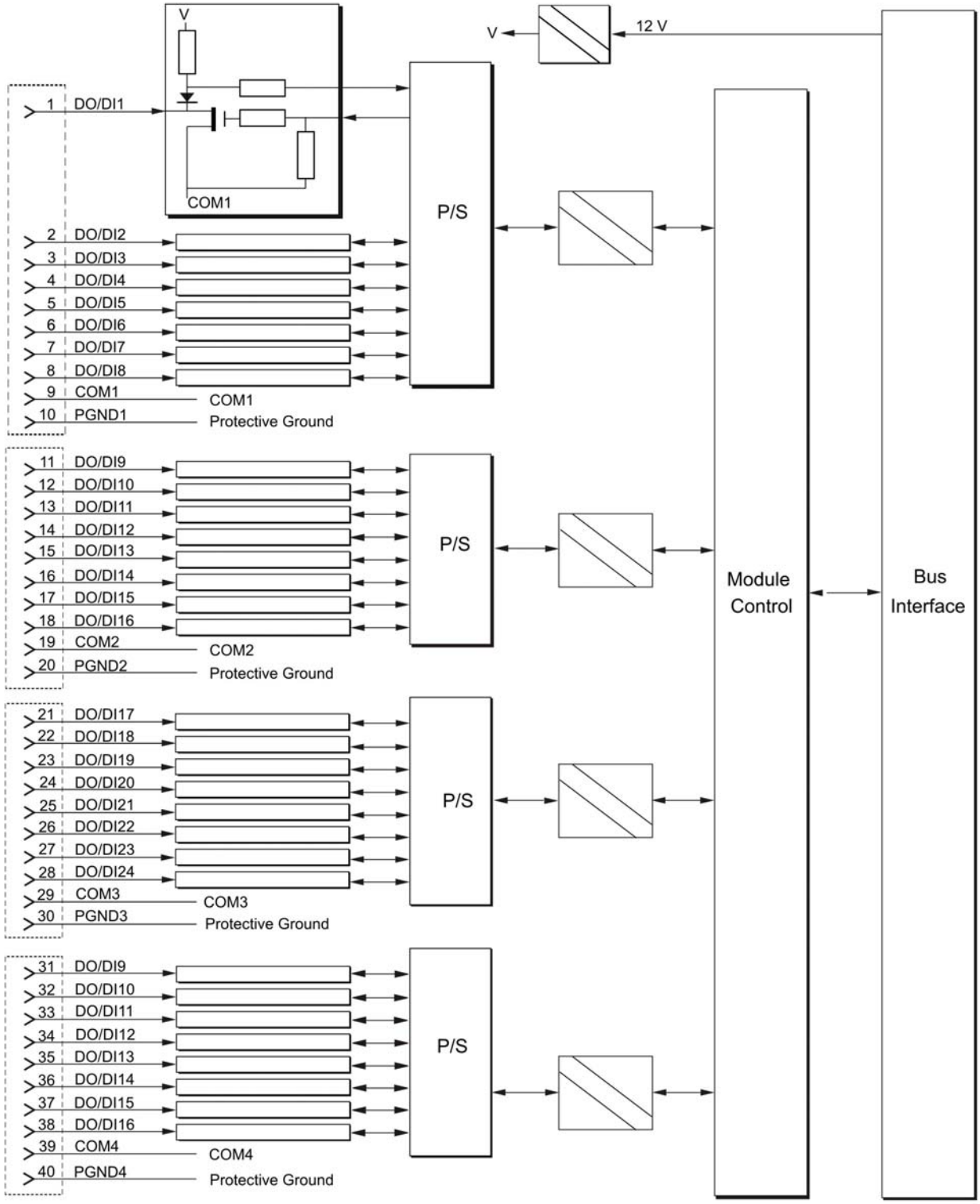
In the Hardware Test utility, it is possible to set the module to Freeze Mode. In this mode the user application program will get the KLV/PDV of each input in the module instead of the actual input value. The DO values will keep the last value they had when the module was switched to Freeze Mode. Freeze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

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
COM1
10 PGND1
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
COM2
20 PGND2
Protective Ground
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
COM3
30 PGND3
Protective Ground
31 DO/DI9
32 DO/DI10
33 DO/DI11
34 DO/DI12
35 DO/DI13
36 DO/DI14
37 DO/DI15
38 DO/DI16
39 COM4
COM4
40 PGND4
Protective Ground
Module Control
Bus Interface

DO/DI FET Module Specifications

Total Number of I/Os	16 (Option V480); 32 (Option V481)
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+16 DI
Counter Inputs	20 first 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)
Counter Input Filtering	0 to 12.75 mS (programmable in 0.05 mSec steps)
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'
Diagnostics 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	40 Wire Cable with Terminal Block Holder connector, 26 AWG
Module Replacement	Hot swap replacement– module extraction / insertion under voltage
Input / Output Isolation	2.5 kV between input/output and module logic
Input Insulation	Insulation resistance 100 MΩ @ 500 V DC per IEC255-5
Operating Voltage	10.5-15.5 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	0.1 W Typical, 0.5 W max. (all LEDs on)
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:

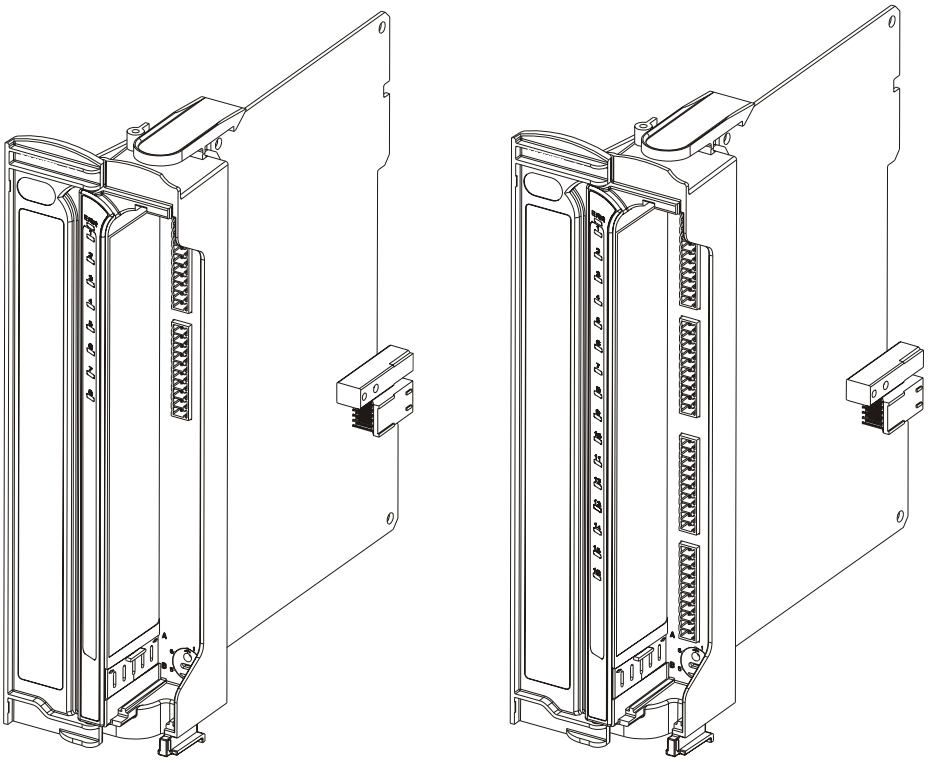
- Electrically Energized (EE) - the outputs return to the non-energized state in case of power off or module failure.
- Magnetically Latched (ML) - Relay outputs are magnetically latched, the outputs maintain their state in case of power off or module failure.

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, TB holder, and other common I/O module features, see the I/O Modules chapter above.

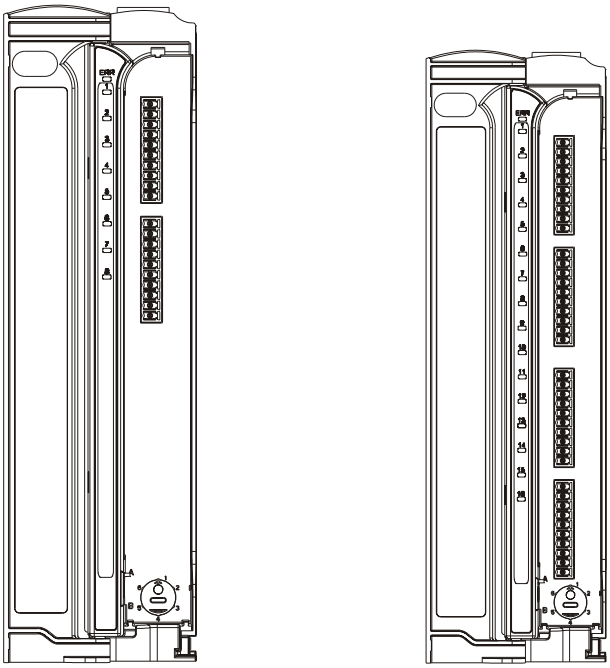
Figure 8-1 provides a general view of the ACE3600 DO Relay Module.



8DO Relay **16 DO Relay**

Figure 8-1 ACE3600 DO Relay Module – General View

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



8DO Relay **16DO Relay**

Figure 8-2 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.)

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

When the dipswitch 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.

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

Table 8-1 DO Relay Module- Dipswitch Settings

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

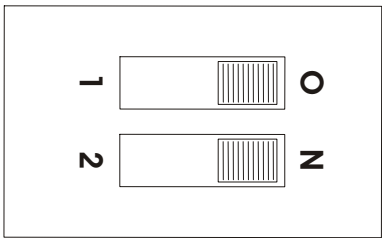


Figure 8-3 12V DO Dipswitch

When S3 is set to Software Selectable mode, the inhibiting configuration is set using the module configuration in the STS Site Configuration (see Table 8-2 below).

Procedure 8-1 describes how to set the 12V DO dipswitch to enable relay inhibiting.

Procedure 8-1 How to Set the 12V DO Dipswitch 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 dipswitch (see Figure 8-3) on the DO module board.
4) Set the S3 dipswitch to the desired position, according to the legend in Table 8-1.
5) Replace the DO module in the rack.
6) If the new dipswitch 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 8-2 ACE3600 DO Relay Module 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	Program I/O link table
DO Mask	No /Yes	No	Output	Program I/O link table
Reset DO at Startup	Disable/Enable	Disable	Module	Site configuration
Relay Inhibiting (SW selectable)	Disable/Enable	Disable	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.

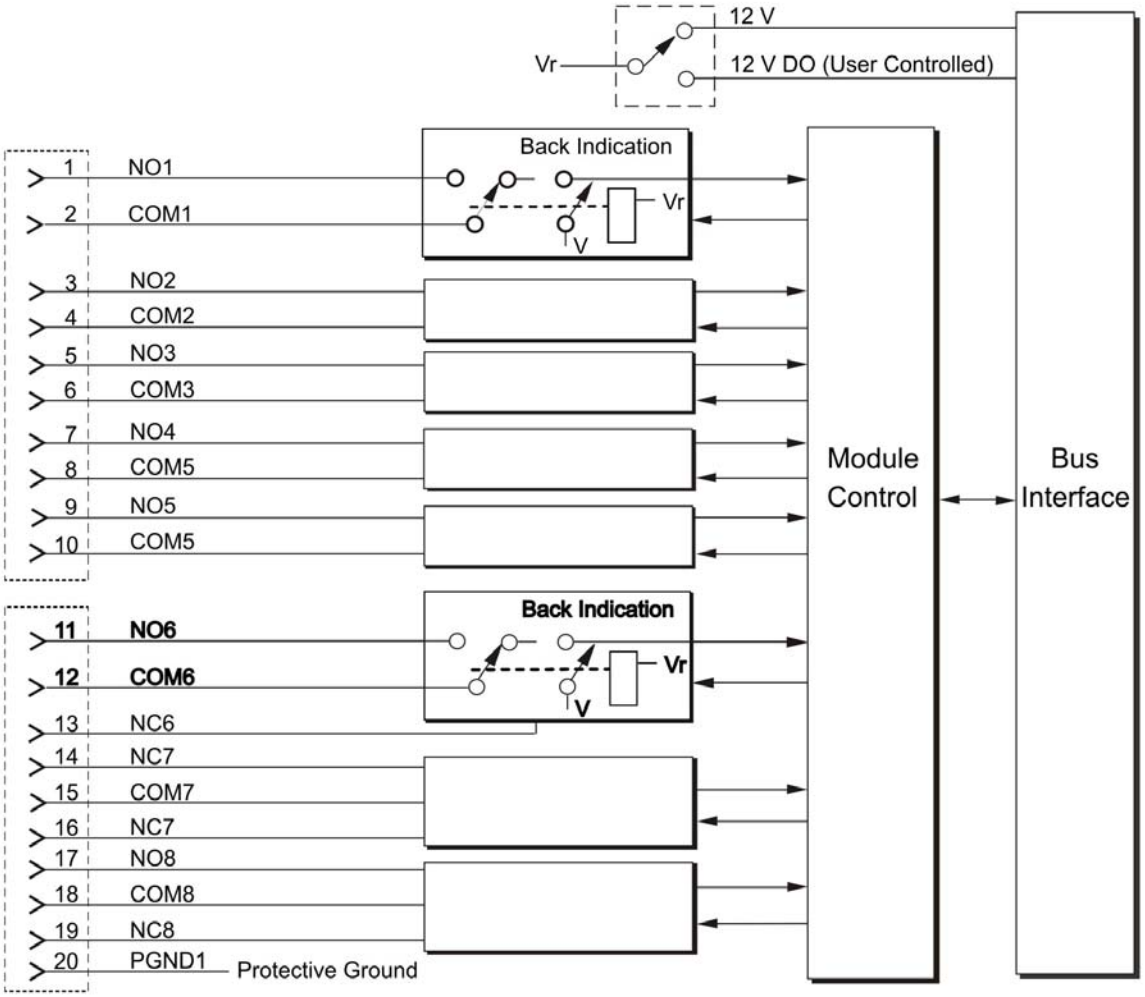
The DO module can be diagnosed and monitored using the STS Hardware Test utility. This test verifies that the module is operational, presents the module configuration and shows the actual value of each output. It is also possible to change the DO's value.

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.

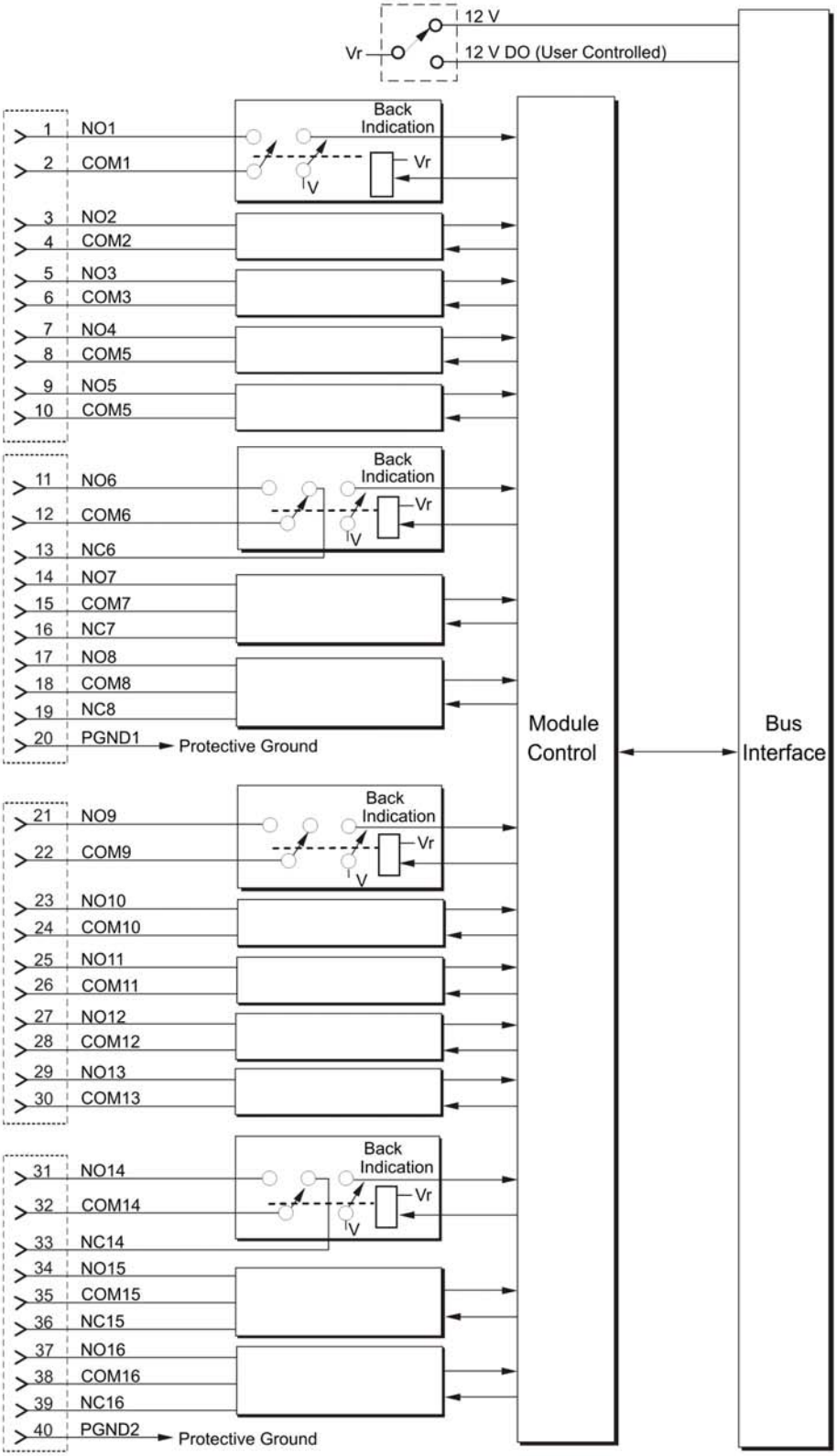
For details on configuring the DO modules, see the Configuring a Site section and the Application Programmer section of the ACE3600 STS User Guide.

Module Block Diagram

8 DO



16 DO


12 V
Vr
12 V DO (User Controlled)
Back Indication
Vr
V
1 NO1
2 COM1
3 NO2
4 COM2
5 NO3
6 COM3
7 NO4
8 COM5
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

DO Relay Module Specifications

Total Number of Outputs	8 EE relay outputs (Option V508) 16 EE relay outputs (Option V616) 8 ML relay outputs (Option V314) 16 ML relay outputs (Option V516)
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
Diagnostics 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 IEC255-5, Insulation impulse 1.5 kV between input and logic
Operating Voltage	10.5-15.5 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	8 D0: 0.25 W Typical, EE: 1.4 W max. (all relays and LEDs on), ML: 0.4 W (LEDs on) 16 D0: 0.25 W Typical, EE: 2.5 W max. (all relays and LEDs on), ML: 0.5 W (LEDs on)
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.

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.

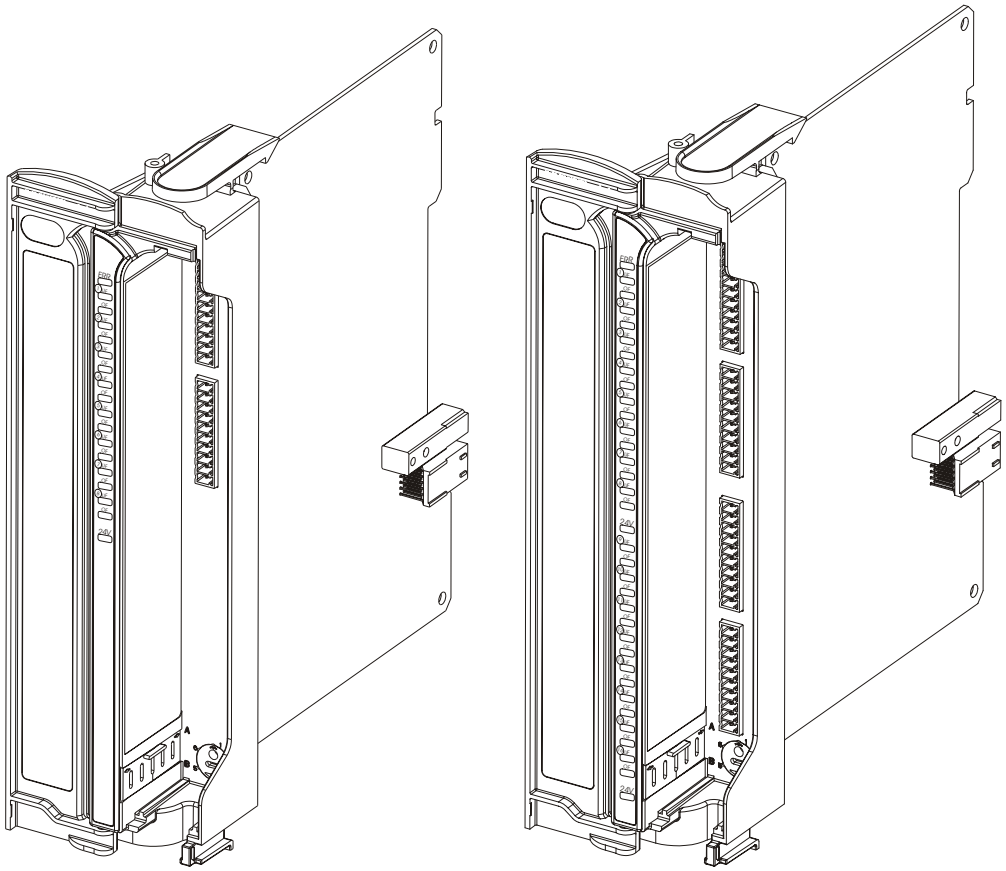
Each analog input has two status LEDs:

- 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.

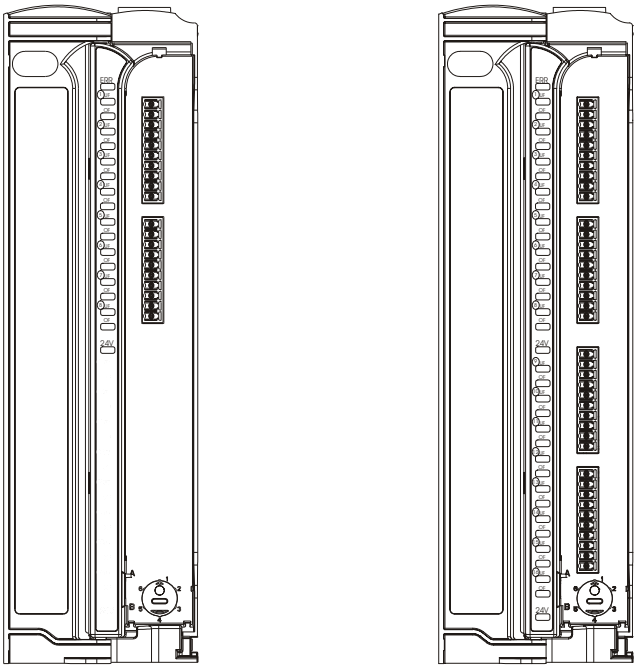
Figure 9-1 provides a general view of the ACE3600 AI module.



8 AI Module **16 AI Module**

Figure 9-1 ACE3600 AI Module – General View

Figure 9-2 provides a detailed view of the AI module front panel.



8 AI Module **16 AI Module**

Figure 9-2 ACE3600 I/O 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 program user will get the PDV instead of the actual input value.

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 9-1 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)	2/4/8/16/32/64/128	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.

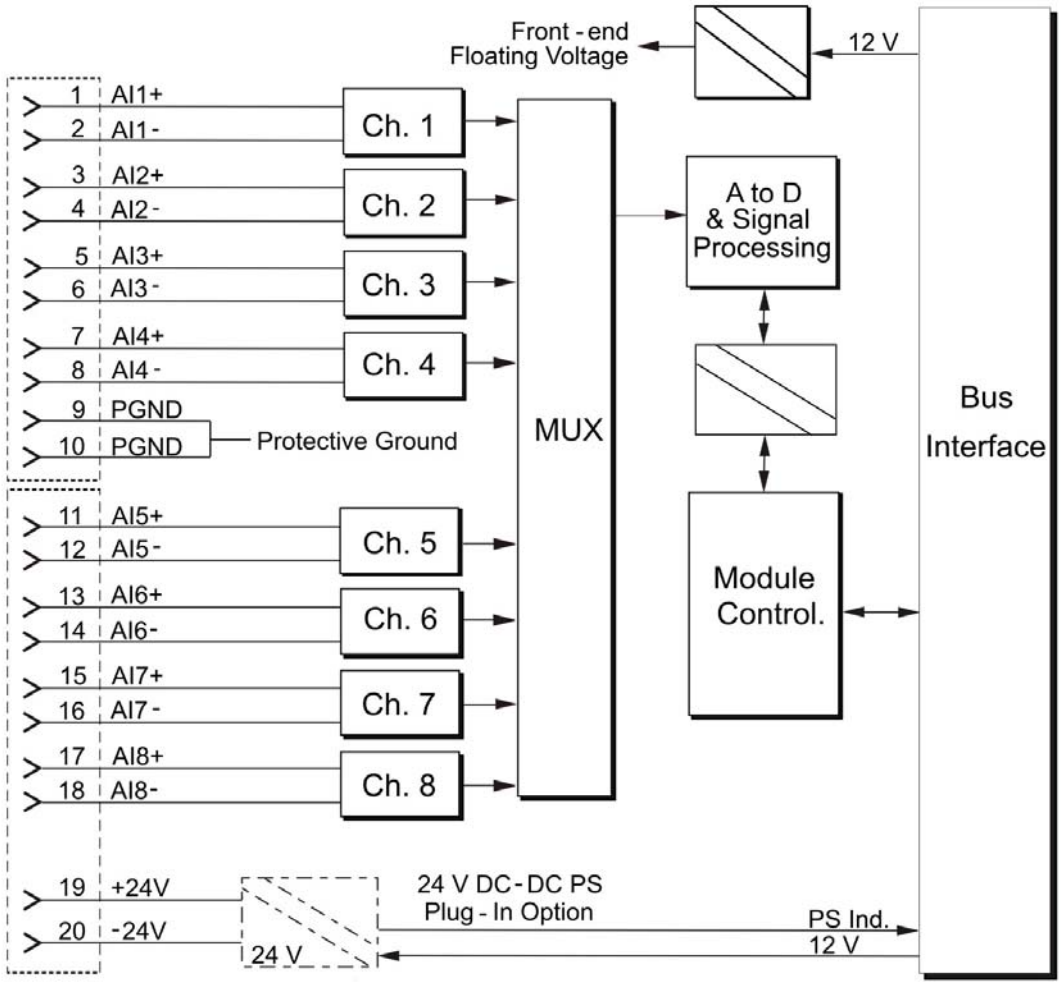
AI Module Value Representation

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

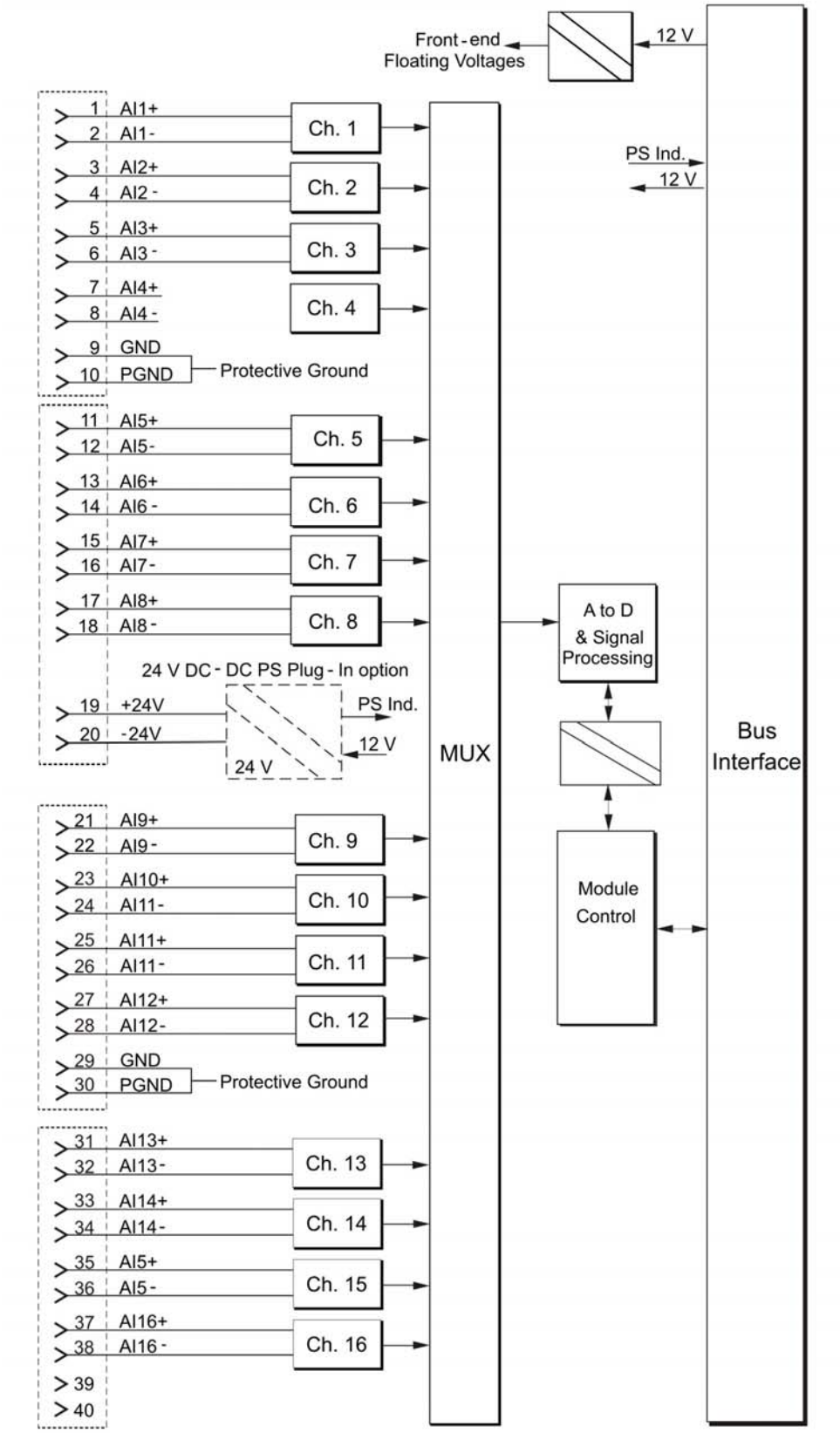
In 4 - 20 mA current inputs	Decimal Value	Input Current	Indication
	< 6144	< 3.84 mA	Underflow LED ON
	6400	+4 mA	Rated range (no LED active)
	0	0 mA	
	32000	+20 mA	
	> 32256	> +20.16 mA	Overflow LED ON
In ± 5 V current inputs	**Decimal Value**	**Input Voltage**	**Indication**
	< -32256	<-5.04V	Underflow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

Module Block Diagram

8 AI



16 AI


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

AI Module Specifications

Total Number of Inputs	8 AI ±20 mA (4-20 mA) (Option V318) 16 AI ±20 mA (4-20 mA) (Option V463) 8 AI ±5 V (0-5 V, 1-5 V) (Option V742) 16 AI ±5 V (0-5 V, 1-5 V) (Option V743)
Input configuration	Isolated (floating) analog inputs
A to D Resolution	16 bit (including sign)
Input Accuracy	±0.1% full scale @ -40ºC to +70ºC
Input sampling time	10 mSec @ 50 Hz filtering 8.33 mSec @ 60 Hz filtering
Smoothing	Selectable input averaging: 2,4,8, 16, 320, 64 or 128 samples
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 > 80 dB, Differential mode rejection > 50 dB
24 V DC output	Supports optional isolated 24V /0.35 A plug-in Power Supply (one in 16 DI, two in 32 DI)
Diagnostics LEDs	Overflow and Underflow LED per each input status, Module error 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 between input and module logic
Input Insulation	Insulation resistance 100 MΩ @ 500 V DC, per IEC255-5
Operating voltage	10.5-15.5 V DC and 3.3 V DC (from the motherboard connector)
Power consumption	8 AI : 0.1 W Typical, 0.5 W Max. (all LEDs on) 16 AI: 0.1 W Typical, 0.3 W Max. (all LEDs on) (Not including Plug-in 24 V Power Supply)
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.

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 10-1 provides a general view of the ACE3600 Mixed I/O module.

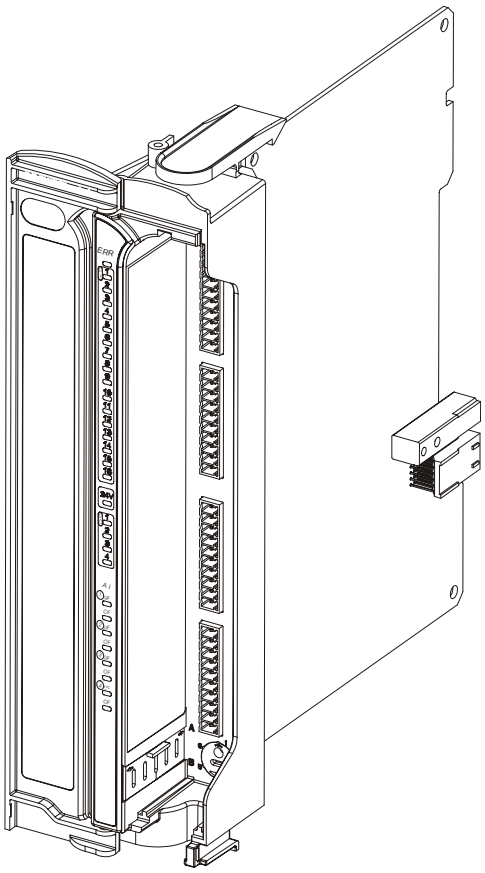


Figure 10-1 ACE3600 Mixed I/O Module – General View

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 10-2 provides a detailed view of the Mixed I/O module front panel.

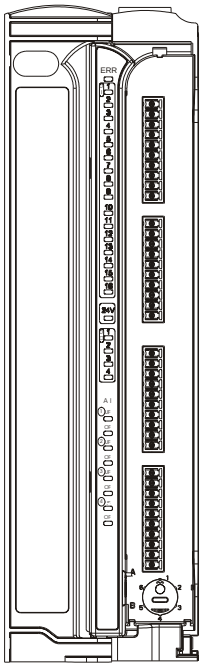


Figure 10-2 ACE3600 Mixed I/O Module – Front Panel

The Digital Input (DIs) on the Mixed I/O modules are voltage ("wet") inputs IEC 61131-2 Type II compliant. All 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.

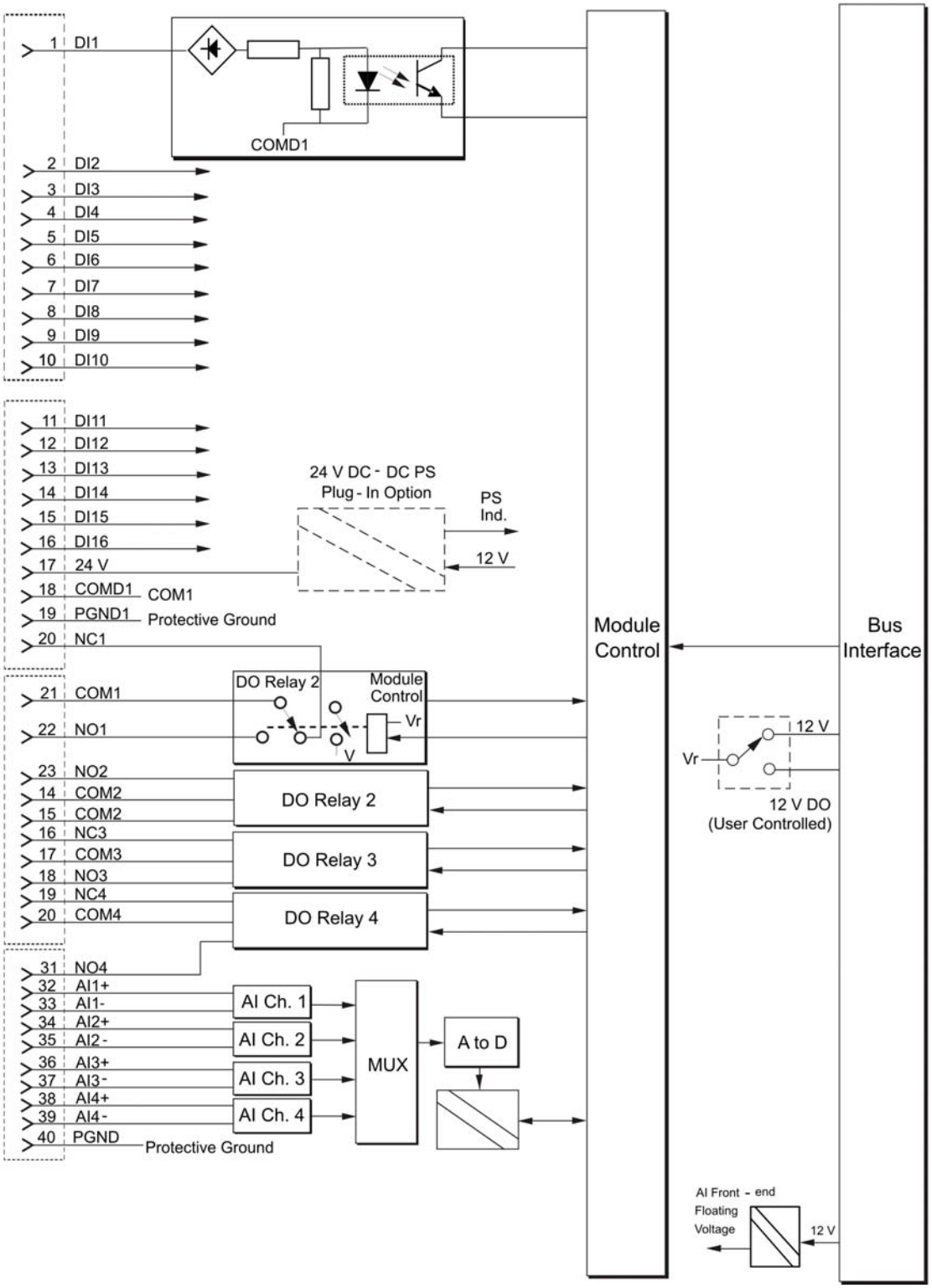
For Hardware Test of the DIs, refer to the DI Module chapter.

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



Mixed I/O Module Specifications

Total Number of Inputs / Outputs	16 Digital Inputs + 4 EE Relay Outputs + 4 Analog Inputs (±20 mA) (Option V245) 16 Digital Inputs + 4 ML Relay Outputs + 4 Analog Inputs (±20 mA) (Option V453)
I/O Arrangement	1 group of 16 DIs with shared common 4 relay outputs - Form C 4 isolated analog inputs
DI Counter Inputs	All inputs can be configured as fast counter
DI Frequency	0 - 1 KHz
DI Fast Counter Frequency	0 - 5 KHz
DI Max. DC Voltage	Max. 40 V DC
DI "ON" DC voltage range	+11 to +30 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 255 mSec (DC, programmable in 1 mSec steps)
DI Counter Filtering	0 to 6.375 mSec (programmable in 0.025 mSec steps for inputs configured as high speed counter)
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% full scale @ -40ºC to +70ºC
AI Sampling time	10 mSec @ 50 Hz filtering 8.33 mSec @ 60 Hz filtering
AI Smoothing	Selectable input averaging: 2,0,8, 16, 30, 60 or 128 samples
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 > 80 dB, differential mode rejection > 50 dB

Diagnostics LEDs	LED per each DO and DI. Overflow and Underflow LED per each 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 / 0.35 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 DC/AC between input and module logic per IEC255-5 DO: Between open contacts: 1kV, between contact and coil: 1.5 kV, between contact sets: 1.5 kV AI: 1.5 kV between input and module logic
Input Insulation	Insulation resistance 100 MΩ @ 500 V DC per IEC255-5
Operating Voltage	10.5-15.5 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	0.1 W Typical, EE: 1.3 W max. (all relays and LEDs on), ML: 0.8 W max. (all LEDs on) (not including Plug-in 24 V Power Supply)
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.

RADIO TYPES AND INSTALLATION KITS

ACE3600 Radio Types

In order to prevent overheating of the radio and and degradation of radio performance, the radio should not exceed operating duty factors of 30% transmission and 70% receive mode.

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
Trunked	XTL5000 (analog trunking mode)	XTL5000 (digital mode)
Conventional	CM200/CM140/EM200/GM3188	
	GP320/GP328/HT750/PRO5150	
	CDM750	

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.

The following table lists all the ACE3600 models that include radios.

Conventional VHF Radio	ACE3600Model
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 XTL5000 136-174 MHz Analog	F7523A
ACE3600 with XTL5000 136-174 MHz Digital	F7513A
Trunked UHF Radio	
ACE3600 with XTL5000 380-520 MHz Analog	F7524A
ACE3600 with XTL5000 380-520 MHz Digital	F7514A
Trunked 800MHz Radio	
ACE3600 with XTL5000 800MHz Analog	F7585A
ACE3600 with XTL5000 800MHz Digital	F7586A

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.

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
Conventional Mobile Radios	CDM750				V143AH/ FLN3638A
	NA	**EMEA**	**APAC**	**LA**	
	CM200	CM140	GM3188	EM200	V148AC/ FLN3635A
Conventional Portable Radios	**NA**	**EMEA**	**APAC**	**LA**	
	HT750	GP320	GP328	PRO5150	V154AE/ FLN3637A

Analog Trunking Mobile Radios	XTL5000	V157AB/ FLN3640A
Digital Trunking Mobile Radios	XTL5000	V681AT/ FLN3649A

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.

XTL5000 Radio Installation Kit

The XTL5000 radio installation kit (ACE3600 option V681AT or V157AB) enables the user to install the XTL5000 radio in ACE3600 Remote Terminal Units (RTU). The ACE3600 can use the XTL5000 in two operation modes, depending on the system used.

- Digital mode (ACE3600 option V681AT) - suitable for Astro 6.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 1.00 and above
- ACE3600 System Tools Suite (STS) version 1.00 and above

The FLN3649A/FLN3640A installation kits include a bracket, cables, and screws.

IMPORTANT: The XTL5000 radio control head must be radio option W4 for revolving power button control head.

Installation

The XTL5000 radio can be mounted on the ACE3600 RTU using the metal bracket and cables as follows:

Procedure 11-1 How to Install the XTL5000 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 radio to the metal bracket (#0789422V41 from FHN6895A) using the four supplied radio screws (#0310906A67), two on each side. (See Figure 11-1.) 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. Connect the opposite side of the signal cable to the port on the CPU module. (See Figure 11-2 and Figure 11-4.) 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 side of the power cable to the AUX2A or AUX2B connector on the ACE3600 power supply unit. (See Figure 11-2 and Figure 11-4.)

Figure 11-1 XTL5000 Radio and Metal Bracket

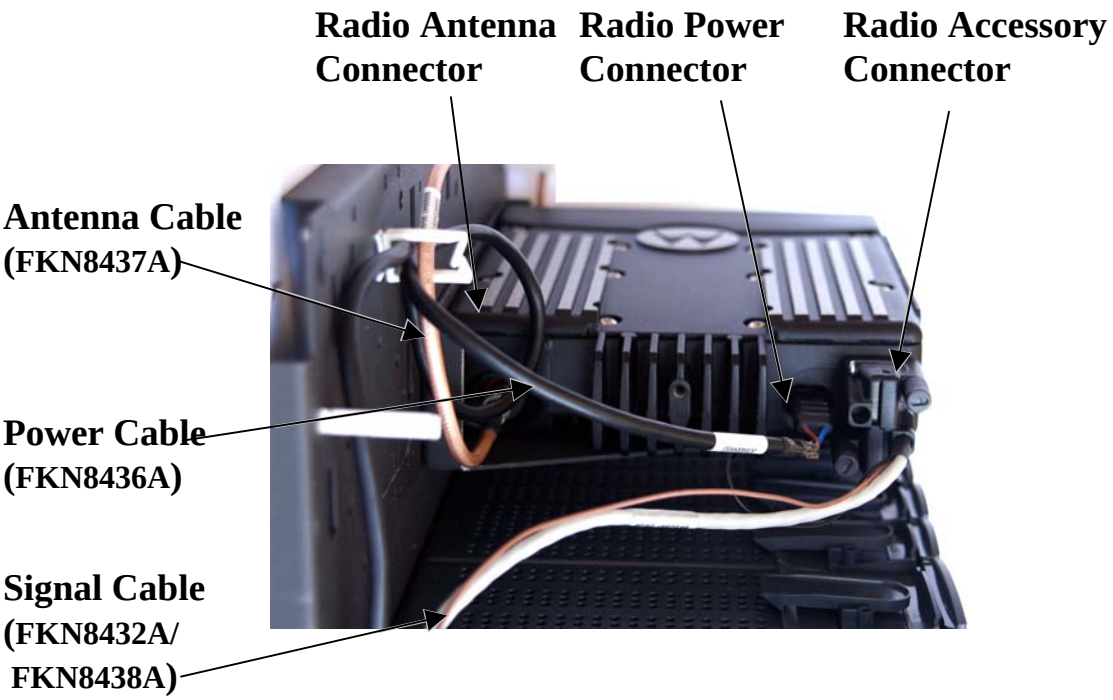


Figure 11-2 XTL5000 Radio Cable Connections- Rear View

5. Mount the bracket on the RTU chassis above the CPU and I/O modules, using the four built-in screws. (See Figure 11-4.) The wider side of the bracket is attached to the chassis.

6. Connect the antenna cable (FKN8437A) to the Antenna connector on the XTL5000. 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 11-2 and Figure 11-4.)

Figure 11-3 XTL5000 Radio Bracket with Four Bracket Mounting Screws

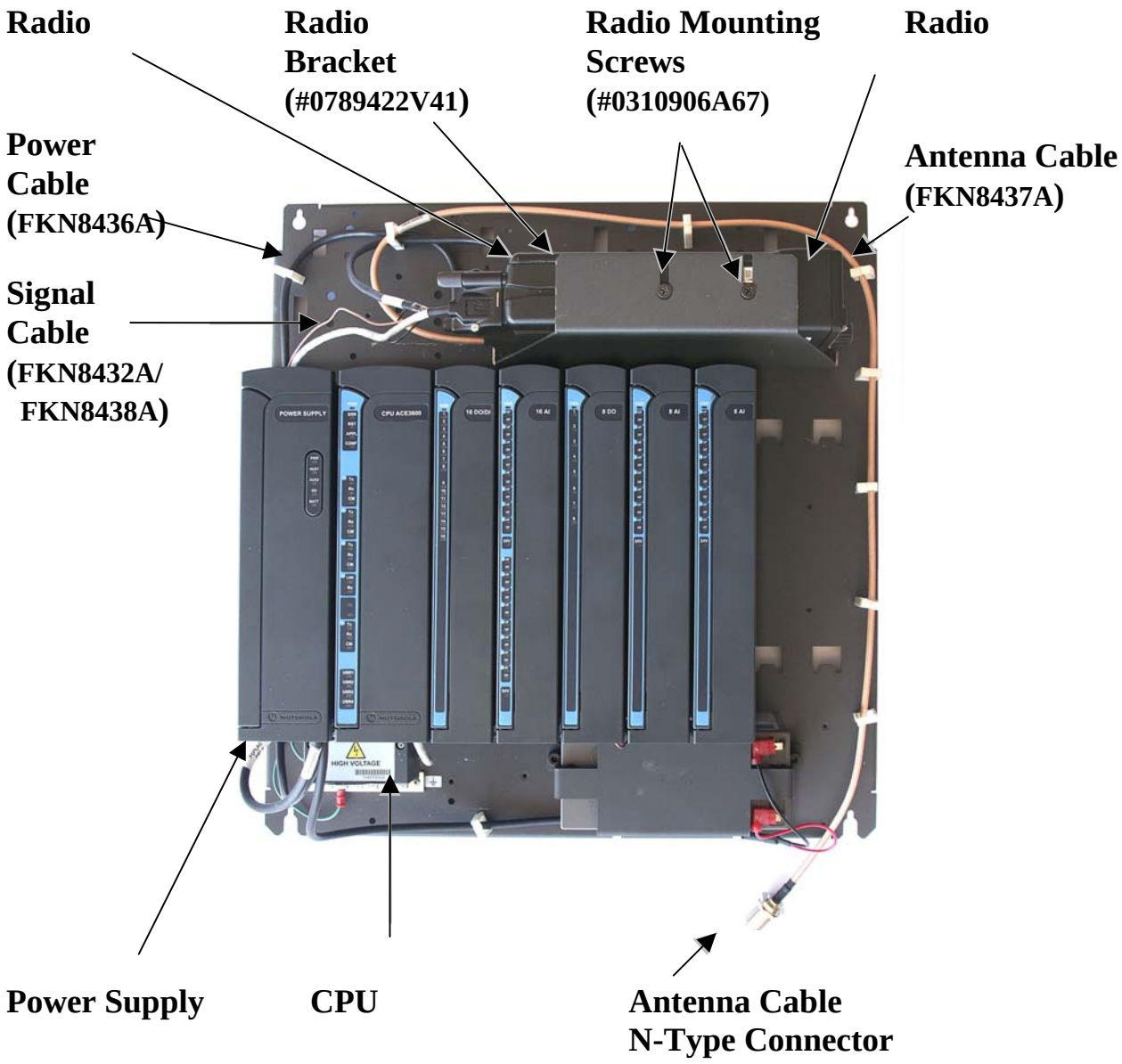


Figure 11-4 XTL5000 Radio Installed on ACE3600 Chassis

RTU Port Configuration for the Astro IV&D Digital Radio

To enable MDLC communication using Astro XTL5000 radios, use the ACE3600 STS site configuration utility to configure the ACE3600 RTU plug-in 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 11-2 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 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.

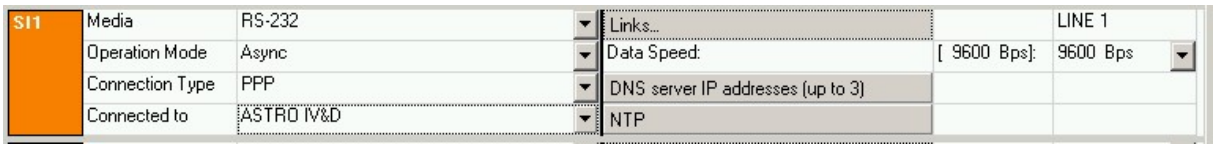


Figure 11-5 RTU Site Configuration for MDLC over ASTRO IV&D – Port Type Parameters

Advanced Parameter Configuration (for Astro IV&D Digital Radio)

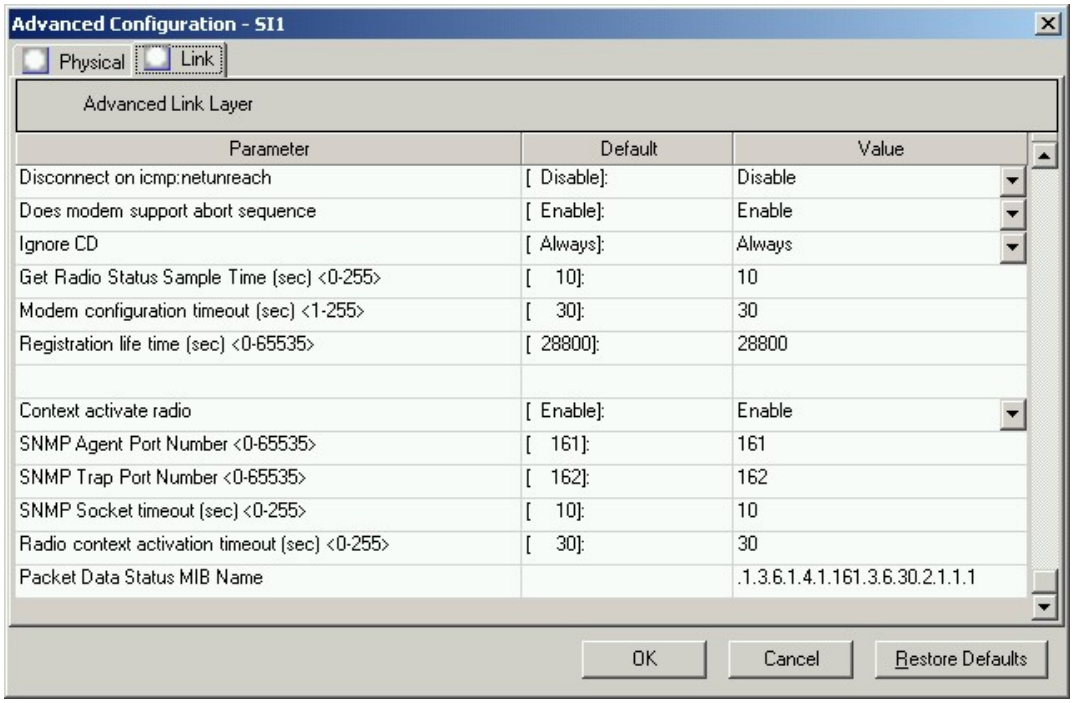


Figure 11-6 RTU Site Configuration for MDLC over ASTRO IV&D – Advanced Parameters

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 11-3 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.

Radio Programming using CPS for the Astro IV&D Digital

The XTL5000 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 radio with Customer Programming Software (CPS), the radio must be connected to a PC.

Procedure 11-4 How to Connect the XTL5000 Radio to the CPS

1. Connect one side 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 side to the serial port of a PC on which the ASTRO CPS software (RVN4185) is installed.

Radio Disassembly

If the XTL5000 radio is to be programmed outside of the ACE3600 housing, disassemble the radio as follows:

Procedure 11-5 How to Disassemble the XTL5000 Radio from the ACE3600 Metal Chassis

1. Disconnect the antenna cable (FKN8437A) to 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 11-1.)

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 11-6 How to Program the XTL5000 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.)

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 W4 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 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 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 11-7 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 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.)

4. Save the changes.

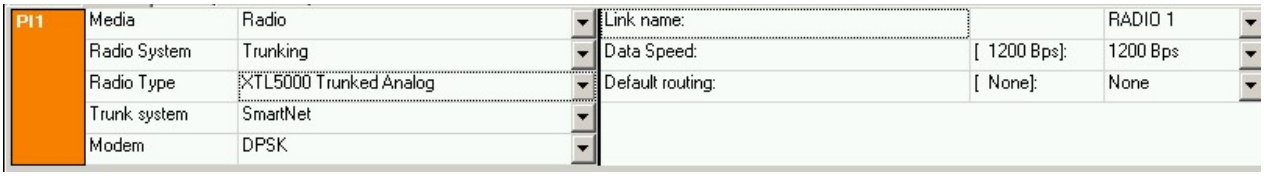


Figure 11-7 RTU Site Configuration for MDLC over Analog Trunked System – Port Type Parameters

Programming the XTL5000 Analog Trunked Radio using CPS

The XTL5000 radio is programmed for ACE3600 in the factory and is ready for analog trunked 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 Radio Programming using CPS for the Astro IV&D Digital above.

Radio Disassembly

Follow the Radio Disassembly instructions described under Radio Programming using CPS for the Astro IV&D Digital 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 11-8 How to Program the XTL5000 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.

   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 that the control head is W4.

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.

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.

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 Radio Models and Options for ACE3600

The XTL5000 radio installation kit is used with one of the following XTL5000 radio:

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
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

All of the following options may be ordered with the XTL5000 radio:

Option Name	Option Number
ADD: W4 CONTROL HEAD	G73
ADD: NO MICROPHONE NEEDED	G90
ENH: SOFTWARE ASTRO DIGITAL CAI OPERATION	G806
ENH: ASTRO PROJECT 25 TRUNKING SOFTWARE	G361
ADD: CONTROL HEAD SOFTWARE, W4	G93
ENH: SMARTZONE OPERATION	G51
ENH: RS232 PACKET DATA INTERFACE	W947
ADD: DASH MOUNT	G66
ADD: NO SPEAKER	G142
ADD: NO ANTENNA	G89

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 11-9 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 11-8.)

3. Connect the power cable (FKN8436A) to the radio power connector, and the opposite side of the cable to the AUX2A or AUX2B connector on the ACE3600 power supply module.

4. Connect the communication cable (FKN8427A) to the rear connector (8-pin RJ45 connector) of FLN3639A. Connect the opposite side of the cable to the plug-in port on the CPU module.

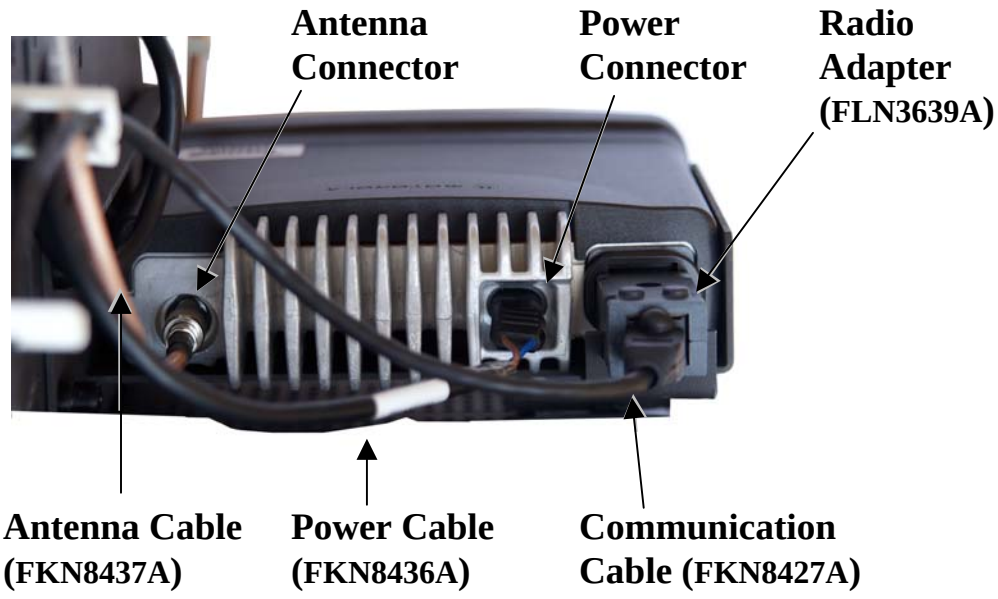


Figure 11-8 CDM750 Antenna, Power and Communication Cable Connections

4. Connect the antenna cable (FKN8437A) 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 11-8 and Figure 11-10.)

5. Attach the radio to the bracket (0789422V45 from FHN6898A) by using screws and washers from kit FHN6898A. See Figure 11-9 below.

Figure 11-9 CDM750 Radio and Metal Bracket

6. Attach the complex (radio + bracket) using the four supplied screws to the ACE3600 chassis. See Figure 11-10 below.

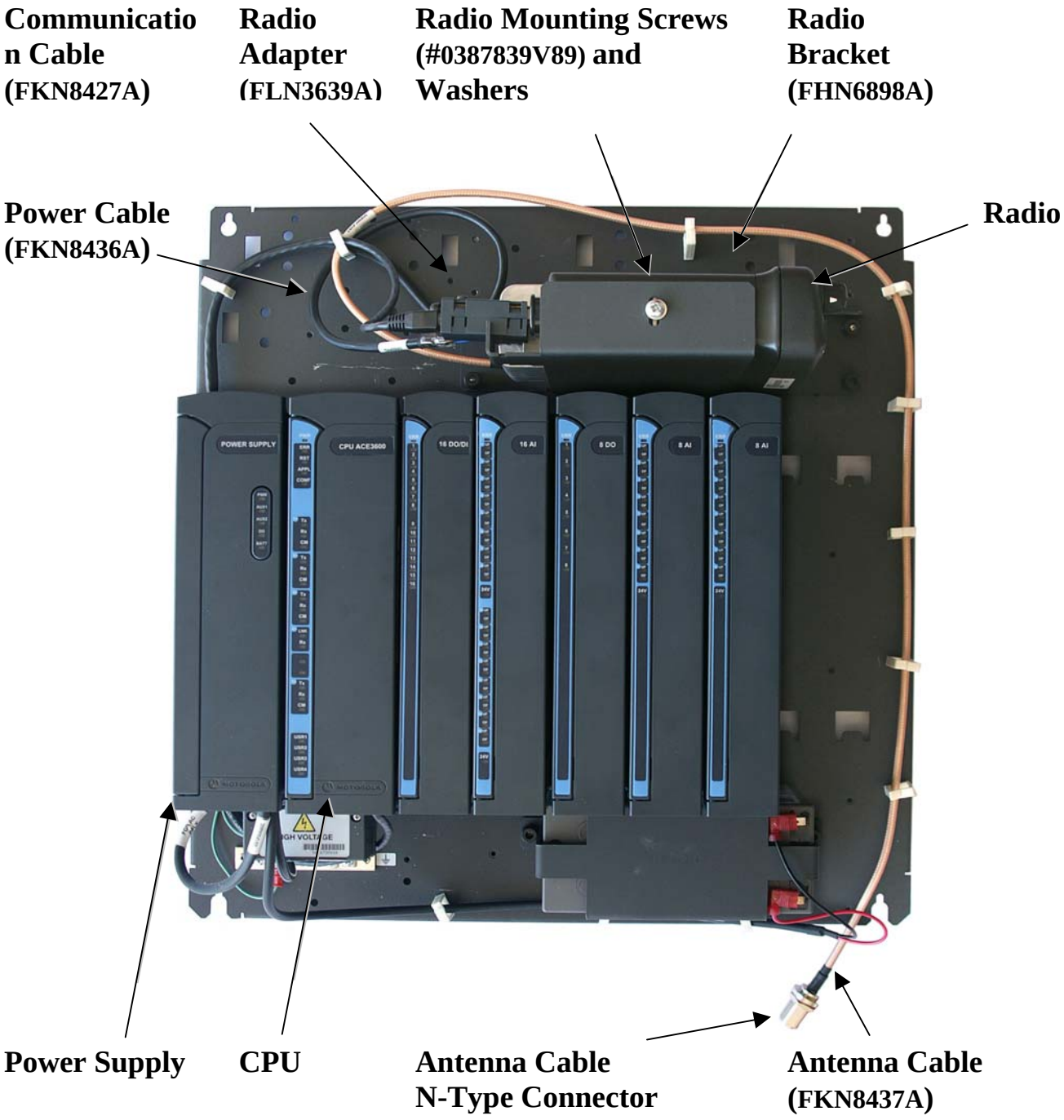


Figure 11-10 CDM750 Radio Installed on ACE3600 Chassis

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 11-10 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.

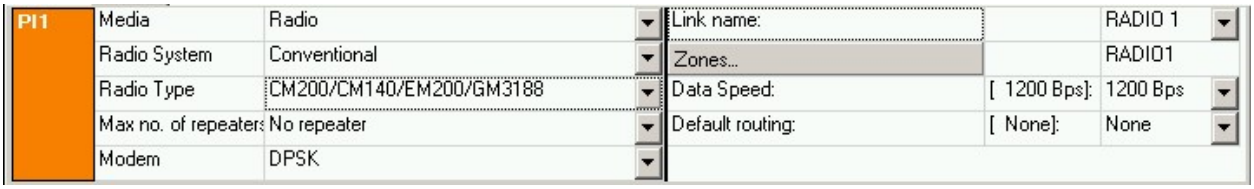


Figure 11-11 RTU Site Configuration for MDLC over CDM750 Radio – Port Type Parameters

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 11-11 How to Connect the CDM750 Radio to the CPS

1. Connect one side of the programming cable (PMKN4004) to the radio Accessory connector and the other side 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 11-12 How to Disassemble the CDM750 Radio from the ACE3600 Metal Chassis

1. Disconnect the antenna cable (FKN8437A) to 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 11-9.)

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 11-13 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.

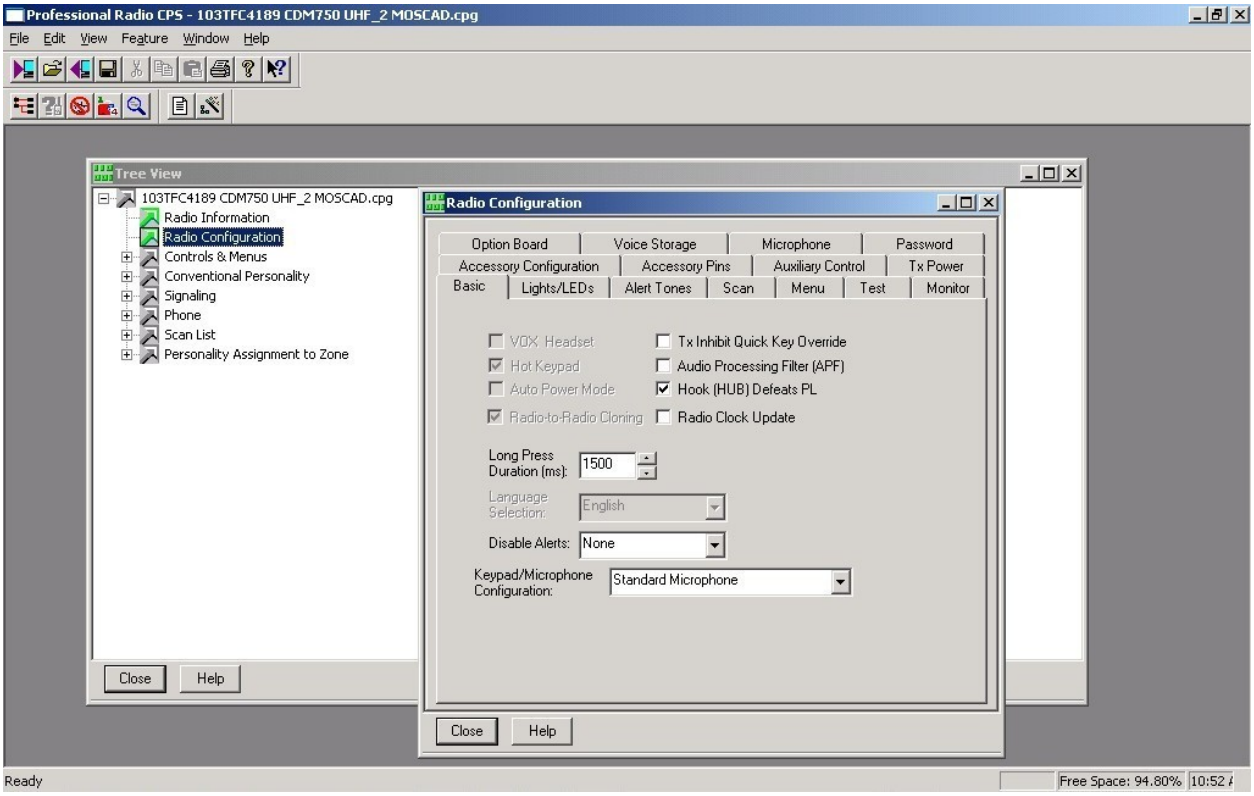


Figure 11-12 Radio Configuration- Basic Settings

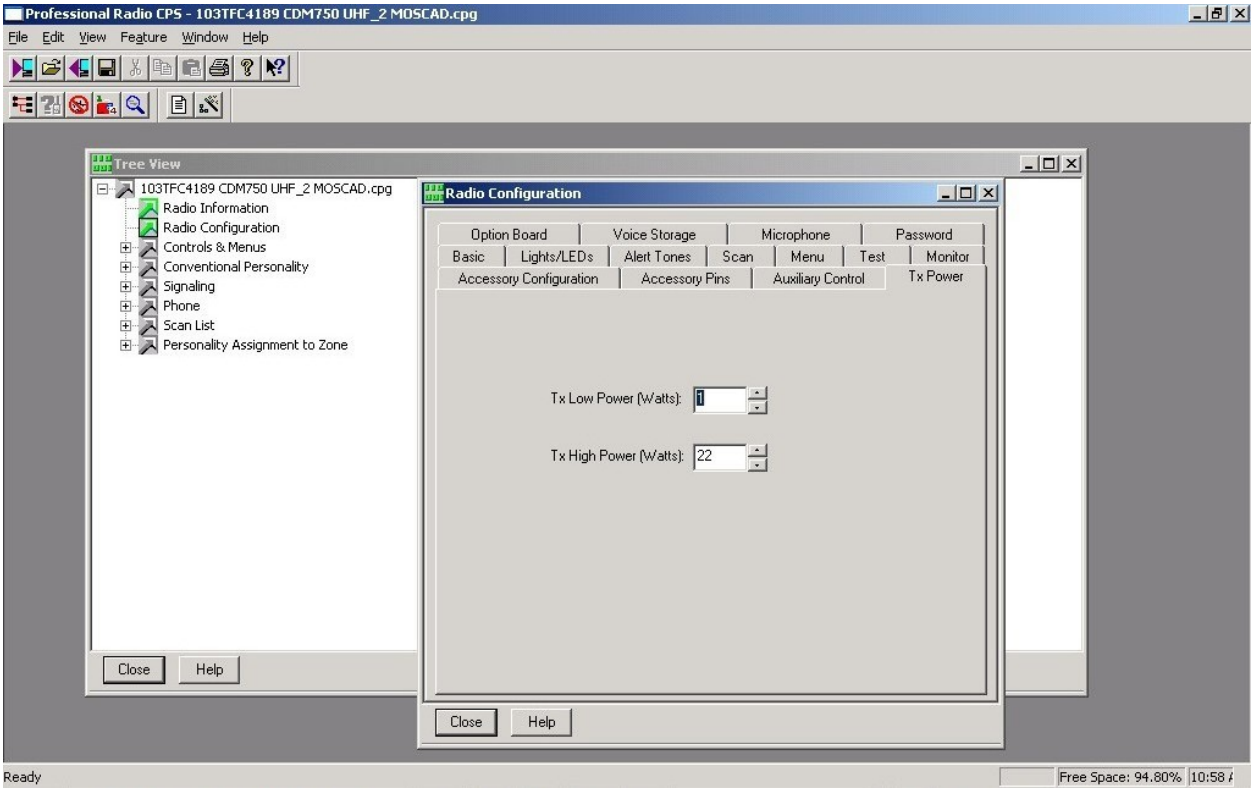


Figure 11-16 Radio Configuration- Tx Power

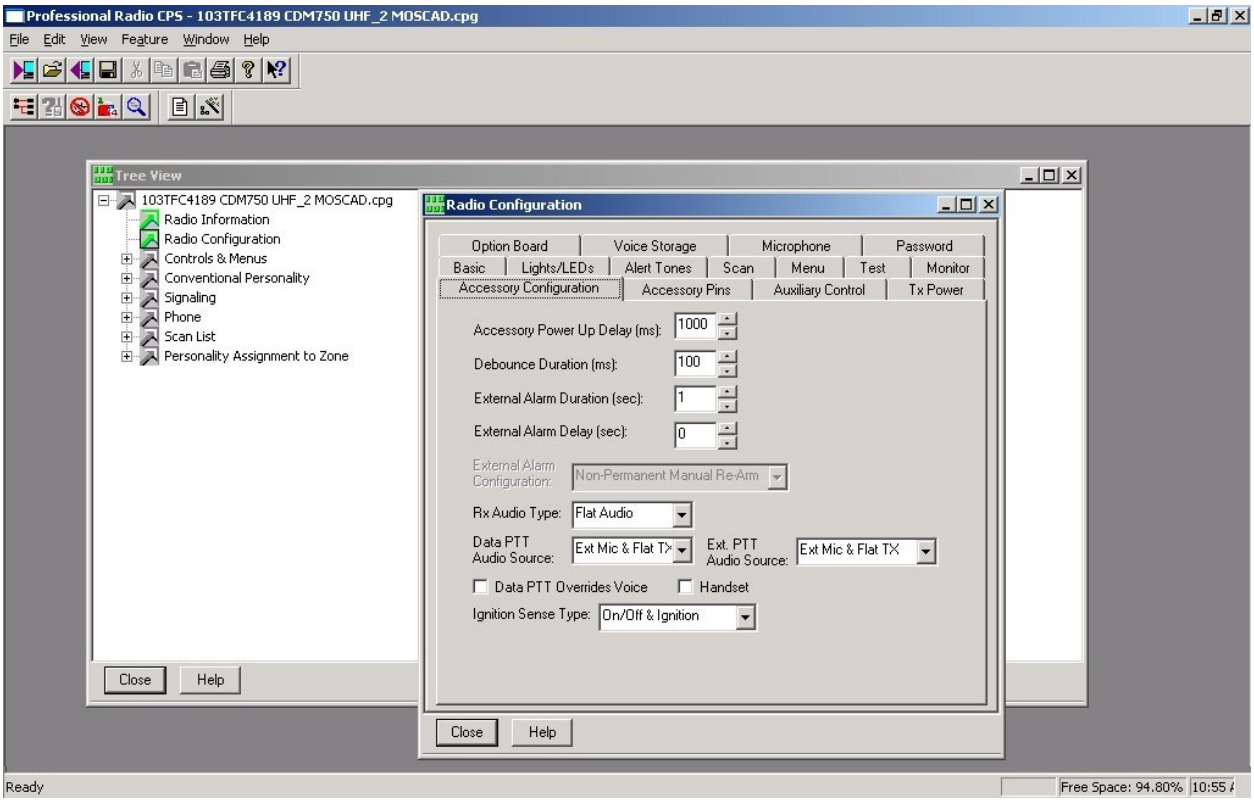


Figure 11-13 Radio Configuration - Accessory Connector Configuration

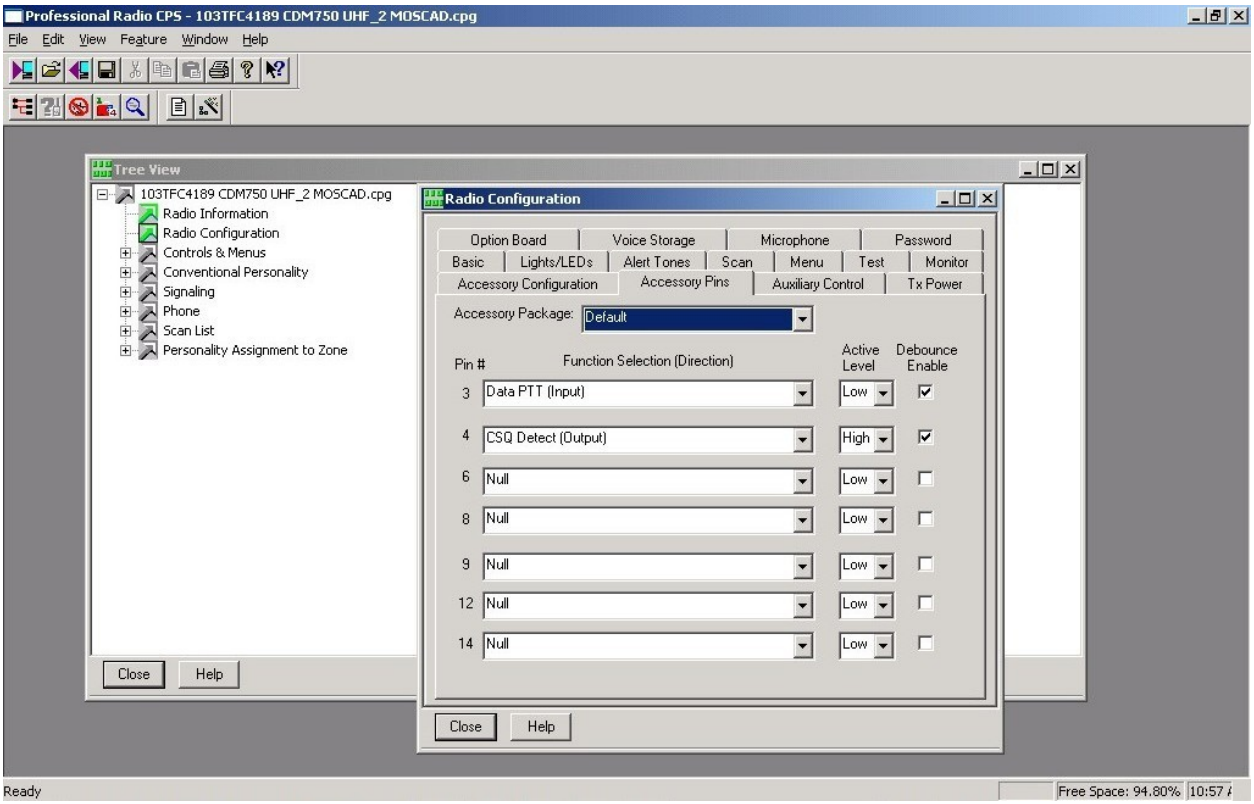


Figure 11-14 Radio Configuration - Accessory Pins Definition

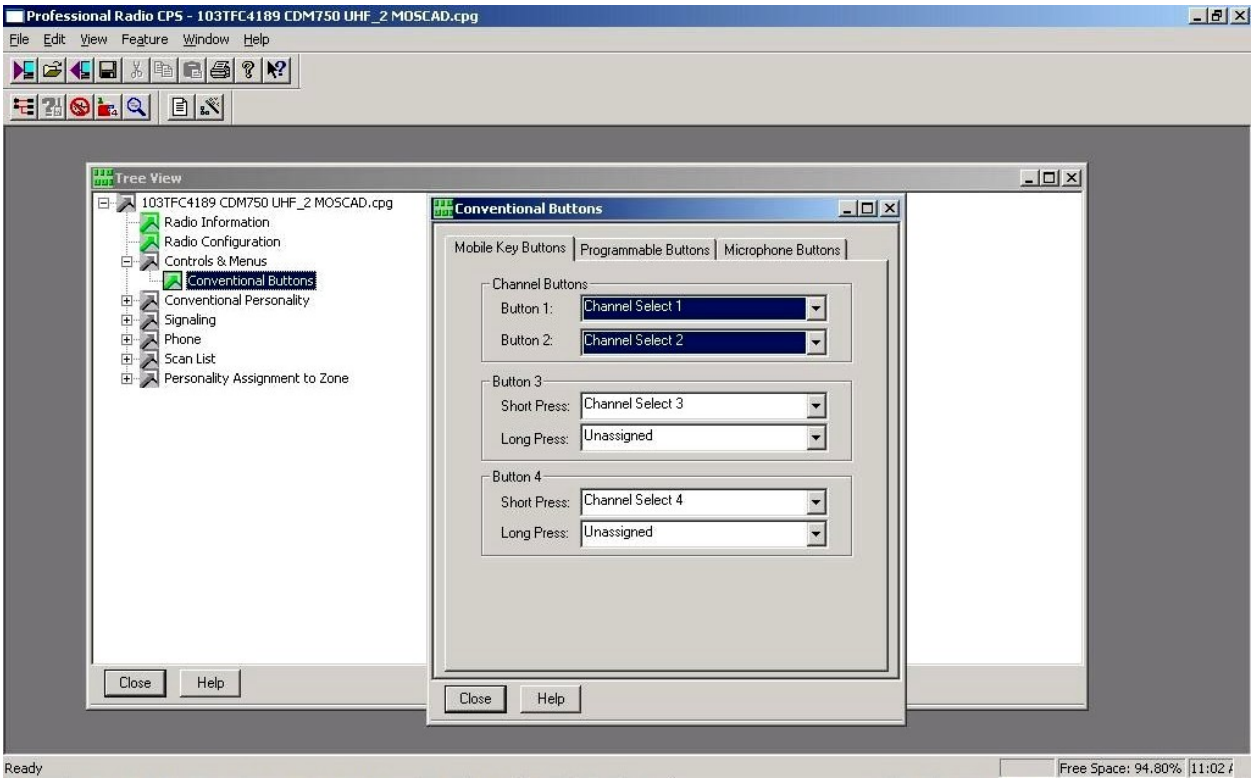


Figure 11-15 Conventional Buttons Configuration – Mobile Key Buttons

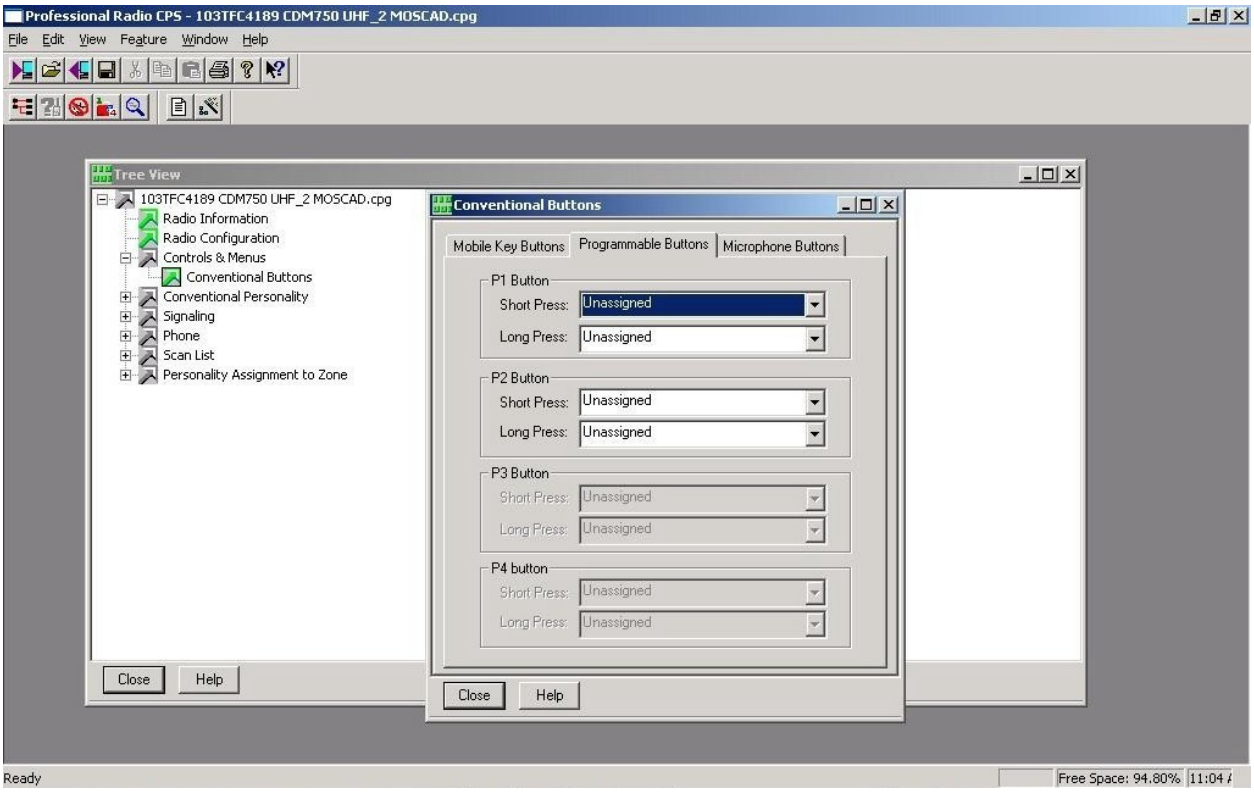


Figure 11-16 Conventional Buttons Configuration – Programmable Buttons

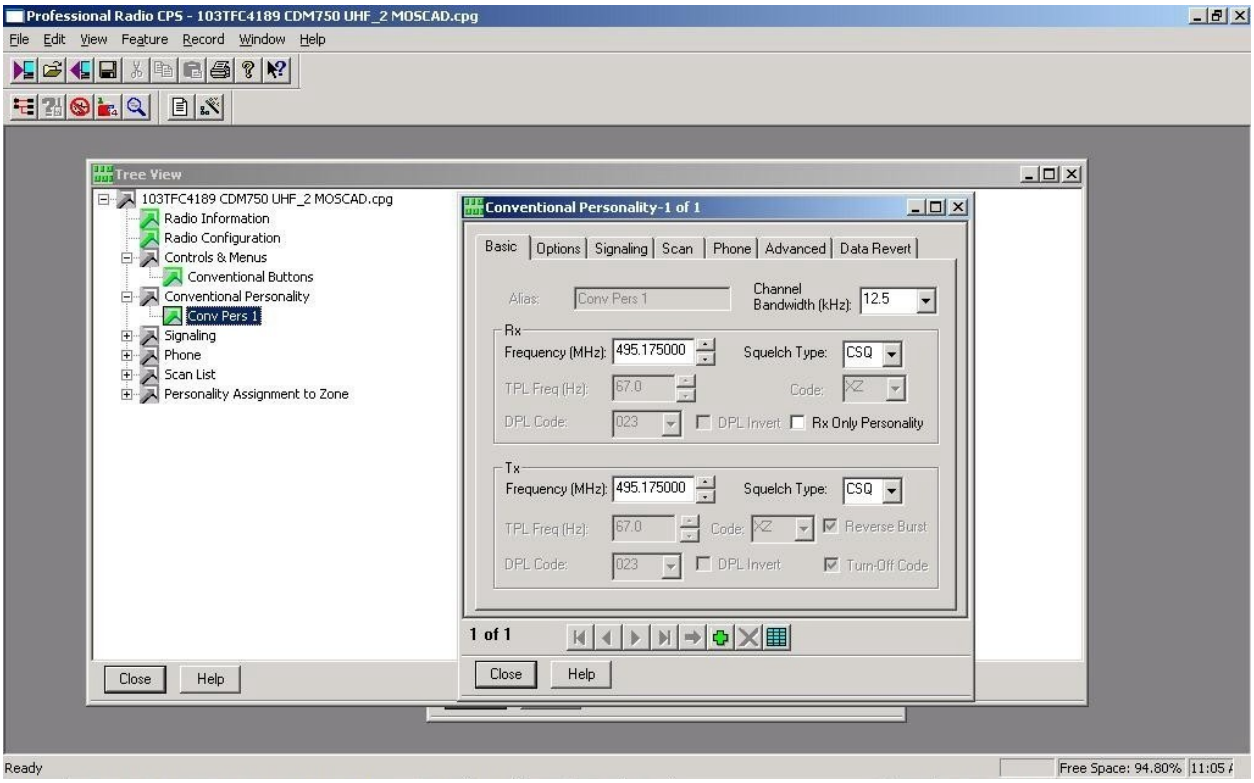


Figure 11-17 Conventional Personality Configuration – Basic Settings

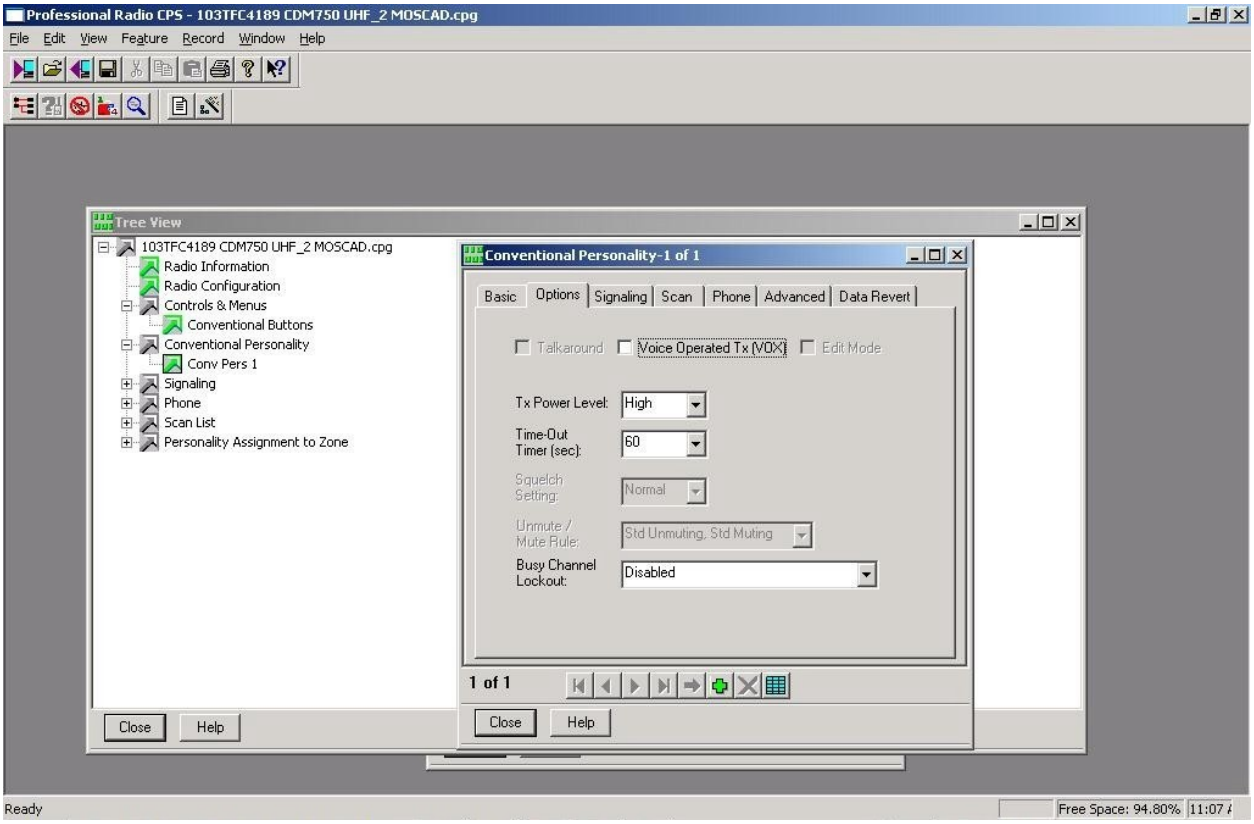


Figure 11-18 Conventional Personality Configuration – Options

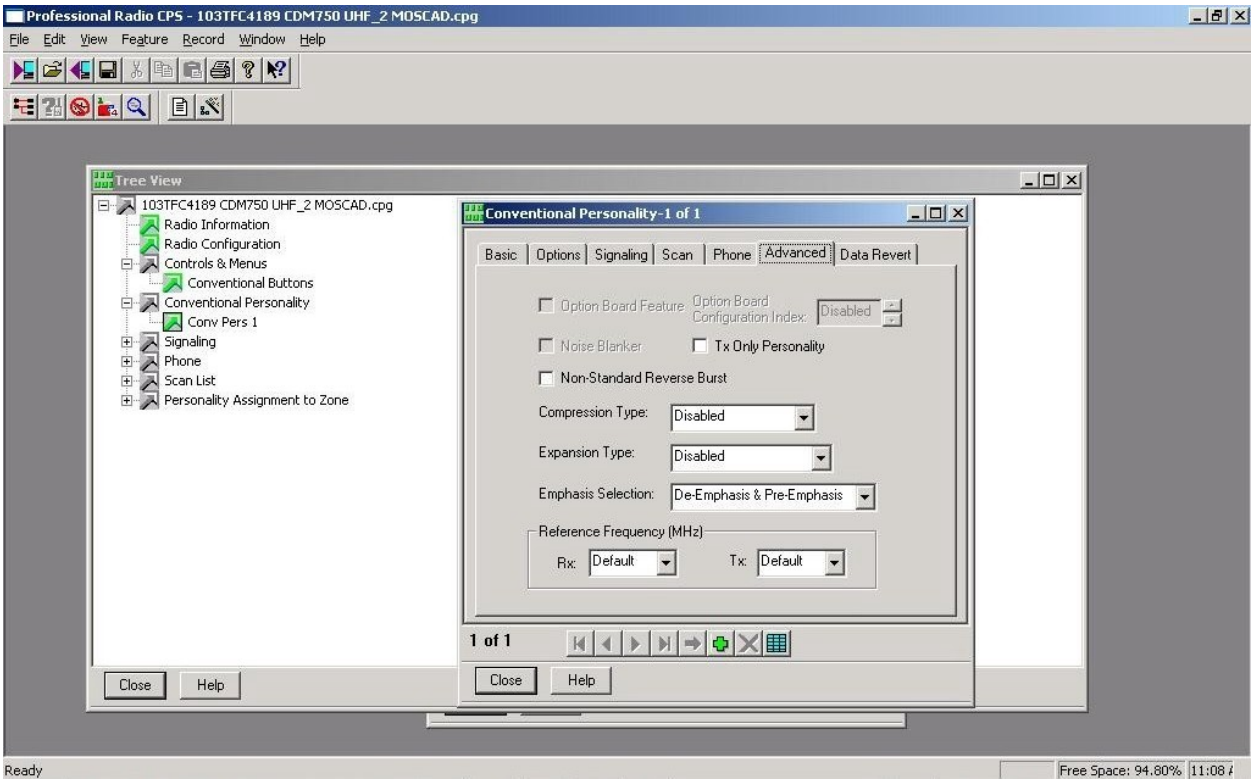


Figure 11-19 Conventional Personality Configuration – Advanced Settings

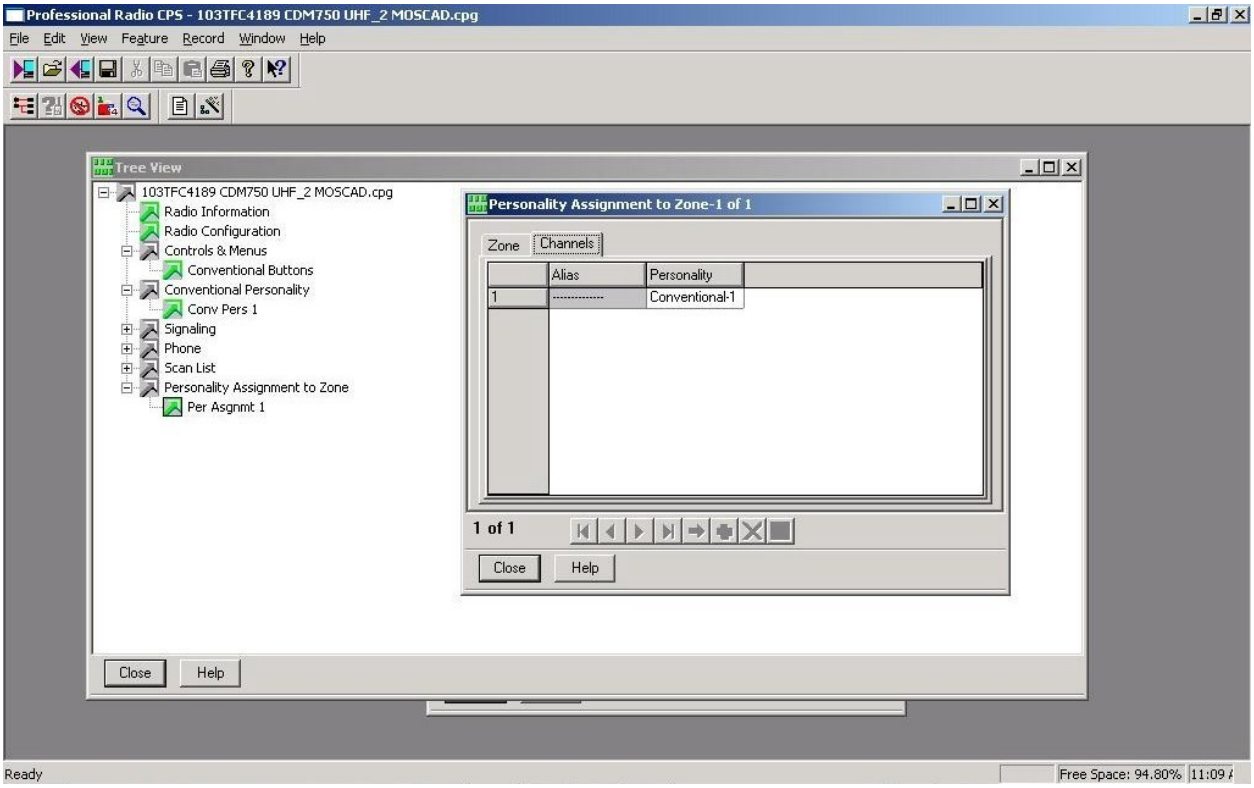


Figure 11-20 Radio Channel Assignment - Personality Assignment to Zone

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 11-14 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 11-21.

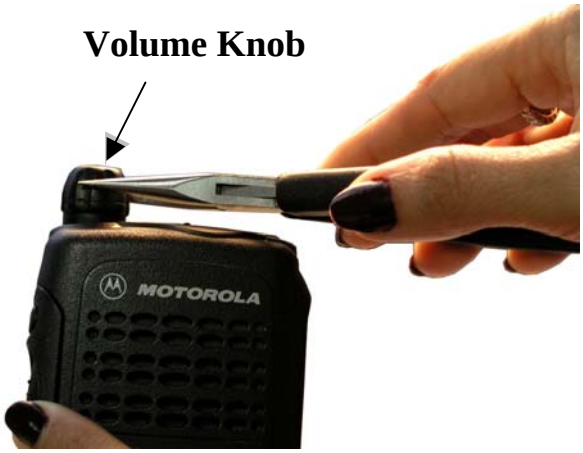


Figure 11-21 Removing the Volume Knob

2. Place the hole of the volume knob retainer (shown in Figure 11-22) over the exposed metal volume rod on the radio (shown in Figure 11-23.)

Figure 11-22 Volume Knob Retainer

3. Fasten the bottom of the volume knob retainer to the radio body. (See Figure 11-23.)

Figure 11-23 Attach Retainer to Radio

Installation

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 (HLN9716C) (Item 1) to the radio. See Figure 11-24.
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 DC power cable (FKN8433A) into the DC connector of the DC adapter (Item 5).

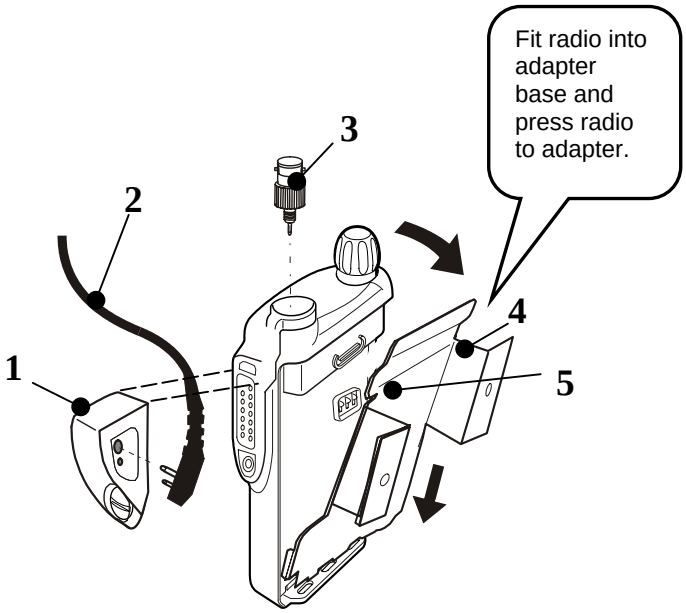


Figure 11-24 GP/HT/PRO Radio Installation

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 11-25.)
9. Connect the audio communication cable (FKN8431A) from the audio adapter (attached to the radio) to the desired plug-in port on the front panel of the CPU module.
10. Connect the DC power cable (FKN8433A) 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 11-25.)

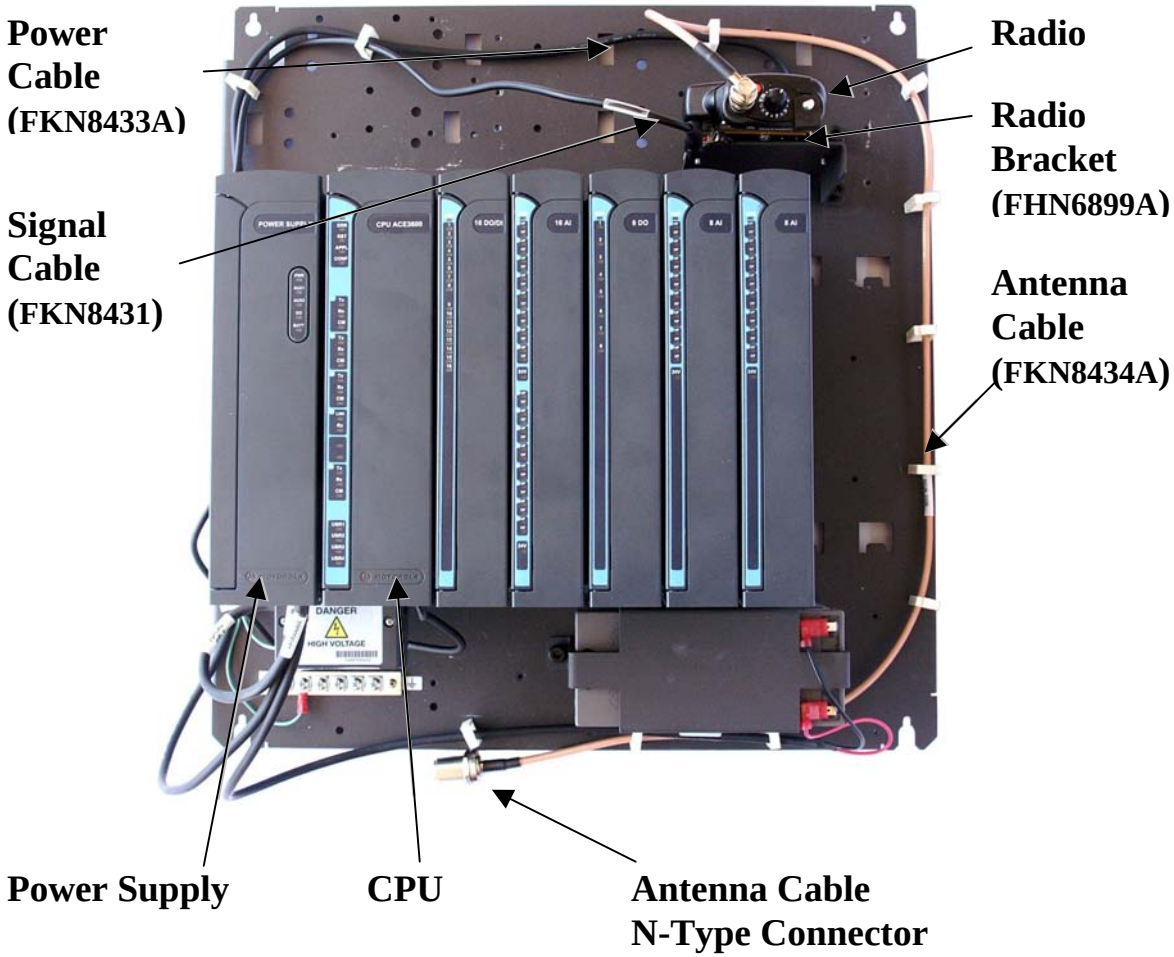


Figure 11-25 GP/HT/PRO Radio Installed on ACE3600 Chassis

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 11-15 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.

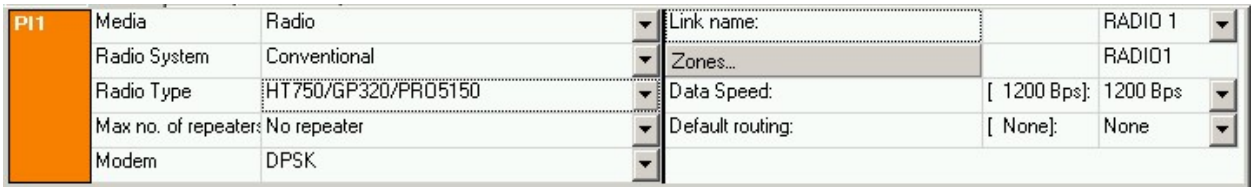


Figure 11-26 RTU Site Configuration for MDLC over GP320/GP328/HT750/PRO5150 Radio – Port Type Parameters

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 11-16 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 11-27.)

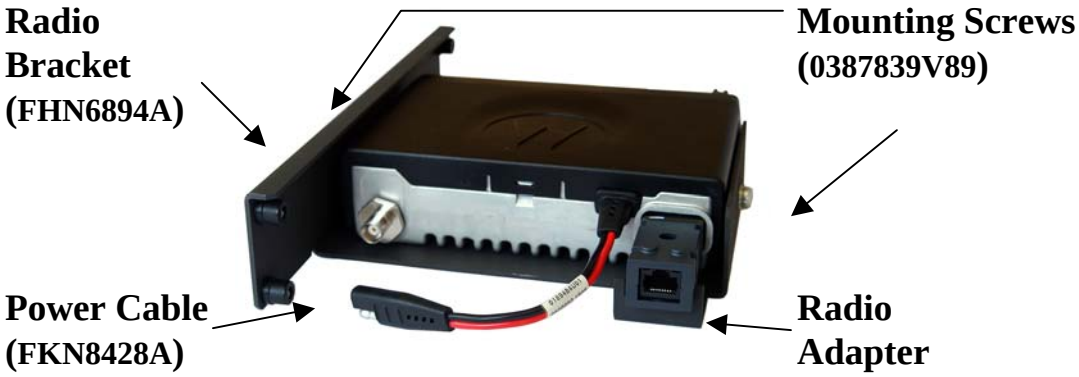


Figure 11-27 CM/EM/GM Radio, Adapter and Power Cable

3. Connect the power cable (FKN8428A) to the radio's power connector. (See Figure 11-27 and Figure 11-28.) Connect the other side of the power cable to the AUX2A or AUX2B connector on the ACE3600 RTU Power Supply unit. (See Figure 11-29.)

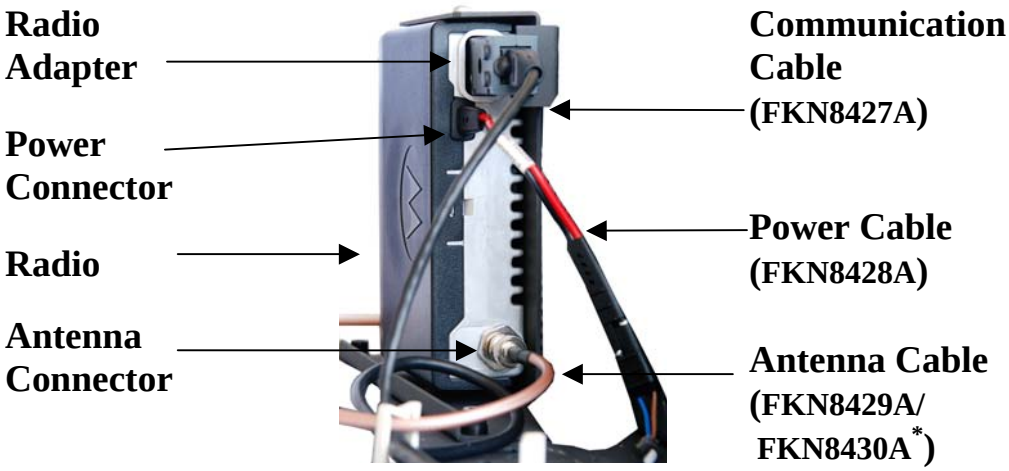


Figure 11-28 CM/EM/GM Radio Cable Connections

4. Connect the communication cable (FKN8427A) to the back of the radio adapter (FLN3636A) connector (10-pin RJ45 connector). (See Figure 11-28.) Add a Fair-Rite soft ferrite (#7683477X01) to the cable near the bottom of the CPU door, and 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 11-27, Figure 11-28 and Figure 11-29.)

6. Connect the antenna cable (FKN8429A/FKN8430A*) 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 11-28 and.) 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 11-29.)

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* Antenna Cable FKN8429A with UHF connector is for Latin and North America.
Antenna Cable FKN8430A with BNC connector is for Asia and Europe.

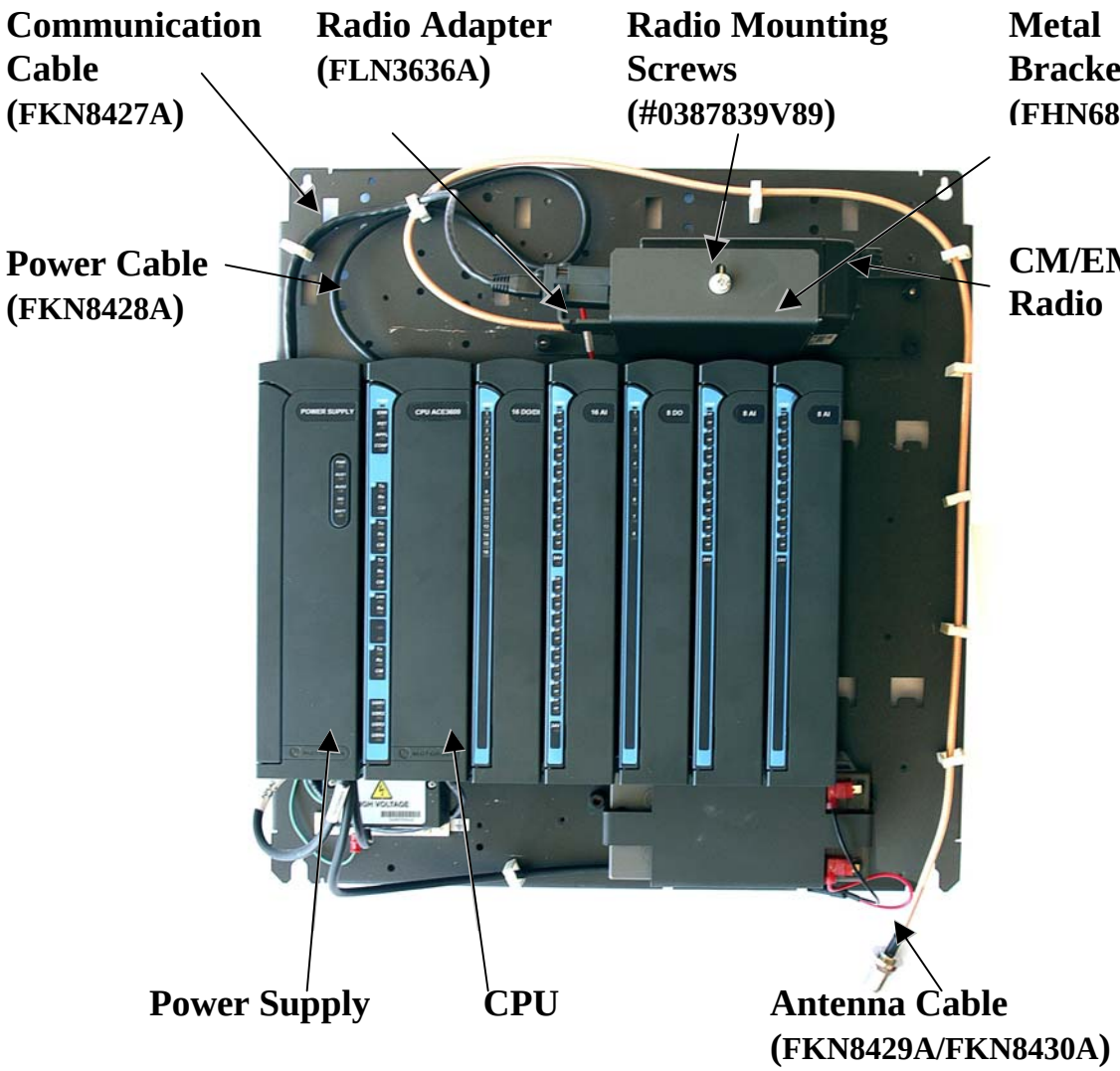


Figure 11-29 CM/EM/GM Radio Installed on ACE3600 Chassis

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.

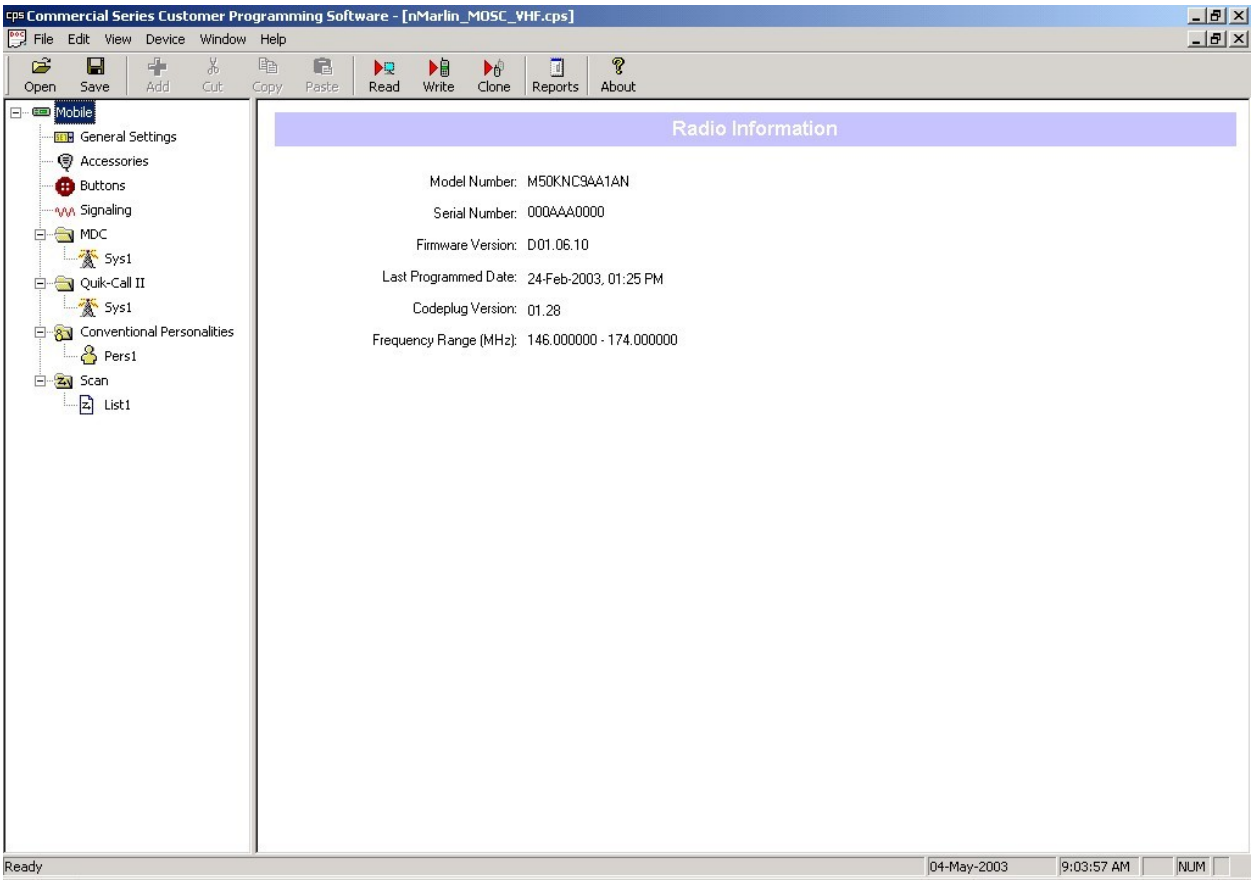


Figure 11-30 CM/EM/GM CPS Radio Information Screen

Radio Power Settings

The picture below shows the TX power setting (1-25 W) in CPS.

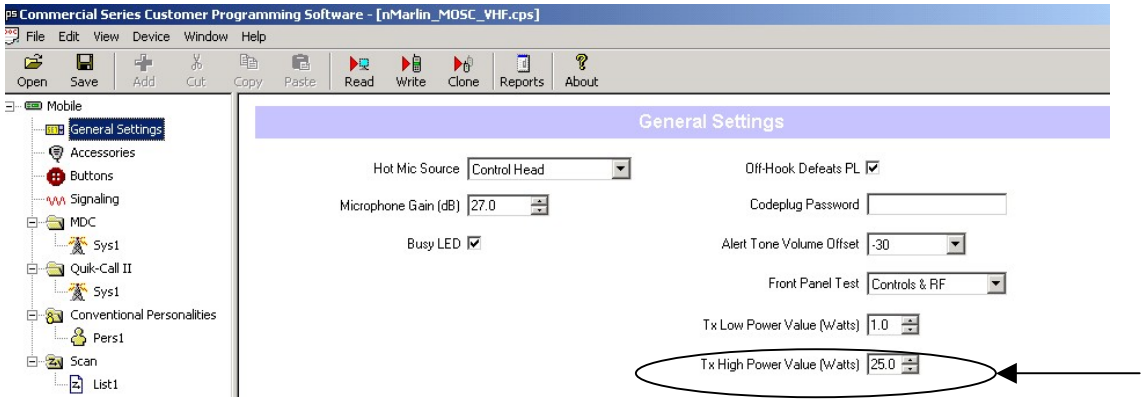


Figure 11-31 CM/EM/GM CPS General Settings Screen

Radio Accessory Connector Pins Definition

The picture below shows the setting of the radio's accessories pins required for interfacing with the ACE3600.

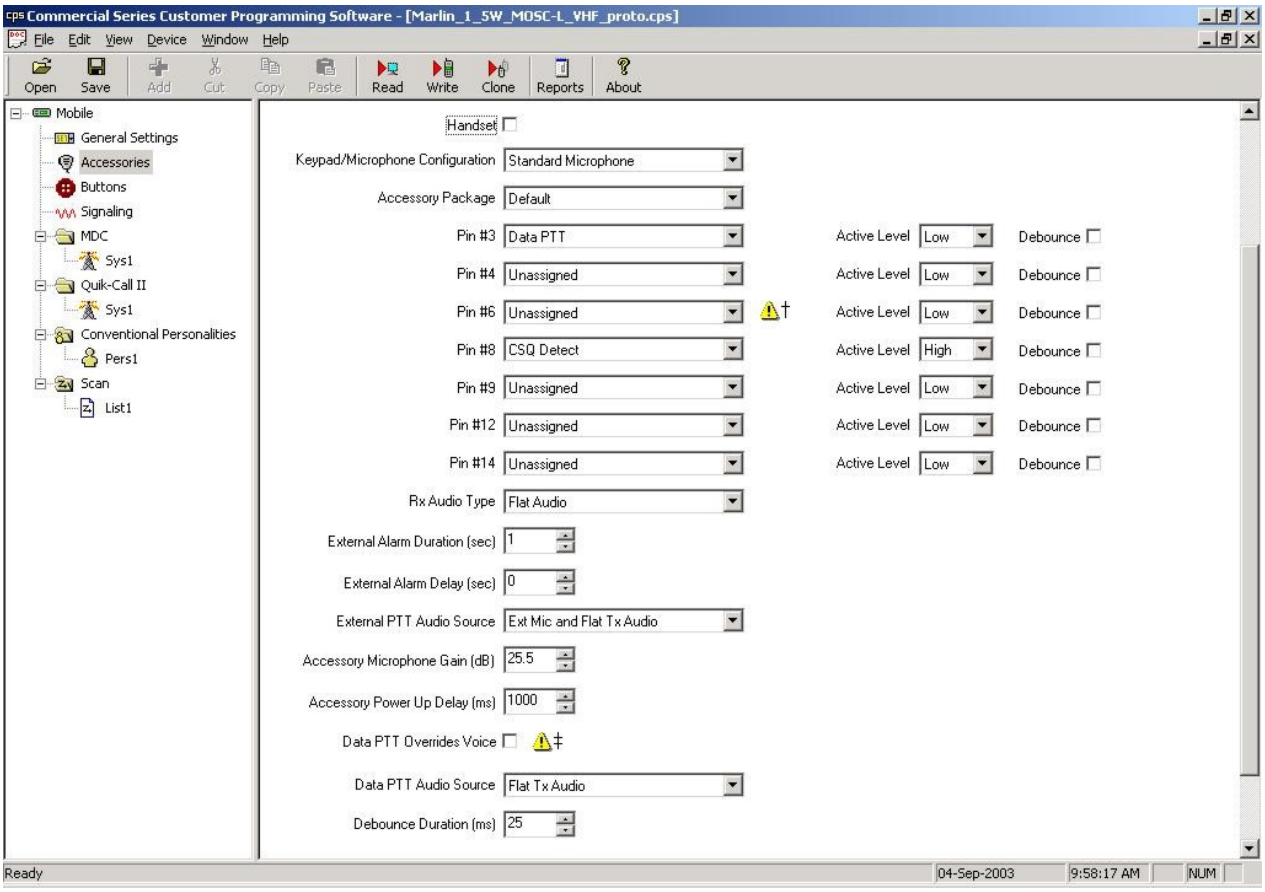


Figure 11-32 CM/EM/GM CPS Radio Accessories Screen

Frequency and Bandwidth Settings

The picture below shows the setting of the radio's frequency, bandwidth and power level.

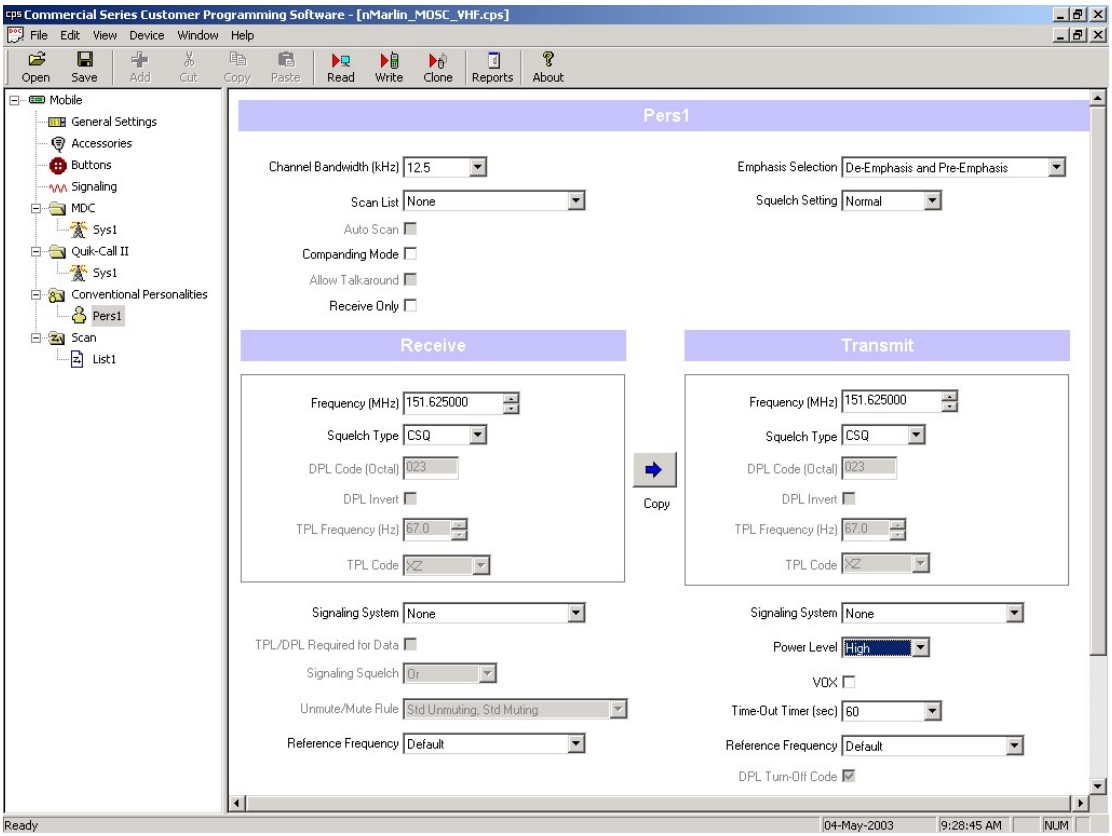


Figure 11-33 CM/EM/GM CPS Radio Personality Tx/Rx Screen

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	

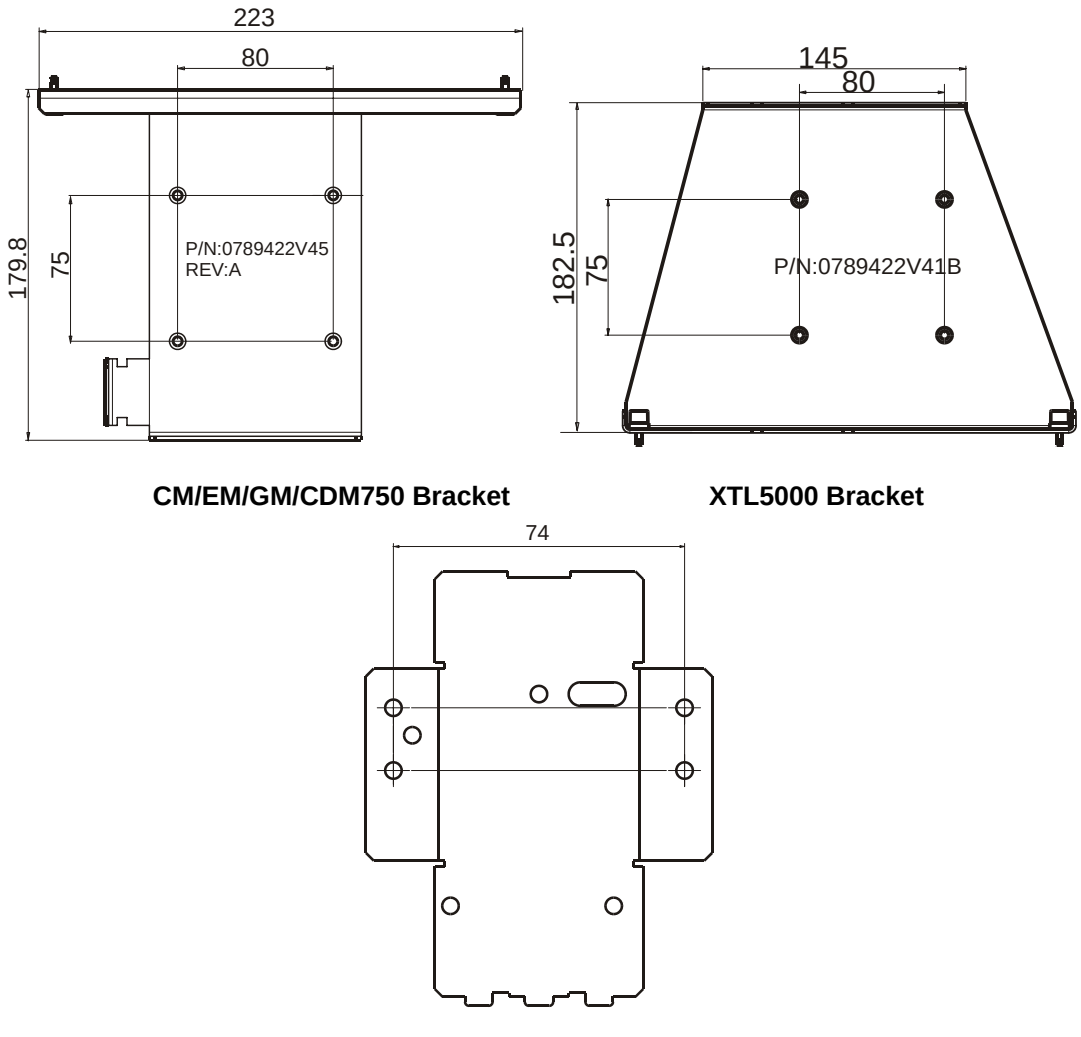
Note:

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.

* Antenna Cable FKN8429A with UHF connector is for Latin and North America.
Antenna Cable FKN8430A with BNC connector is for Asia and Europe.

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.



CM/EM/GM/CDM750 Bracket **XTL5000 Bracket**

GP/HT/PRO Bracket
Figure 11-34 Radio Wall Mount Brackets

Procedure 11-17 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 11-34 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.

PLASTIC BOX INTERFACES

Plastic Box Interfaces

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

Procedure 12-1 How to Install the Plastic Box Interface on the Metal Chassis

1) To connect the plastic box interface to the metal plate, place the box on the metal plate and click into holes. See Figure 12-1.

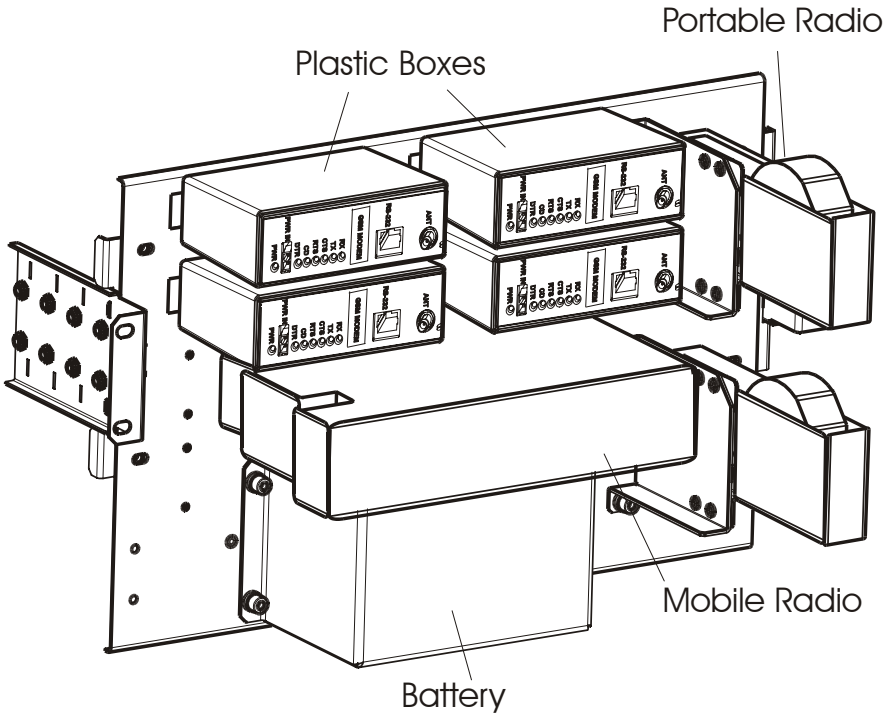


Figure 12-1 Accessories Installed on a Metal Chassis

CONFIGURATION

General

For information on setting the 12V DO dipswitch in the DO relay module board, see the Digital Output Relay 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.

See the ACE3600 STS User Guide for details.

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 - run the short battery test (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 module front panel is not lit.	Check power connections to the unit. If all connections are correct, check cables.
The Power LED on the CPU module front panel is red.	The CPU has received an error from the power supply (AC fail, Bat Error etc.) Check the AC power supply, backup battery, etc.
The ERR LED on the CPU module front panel is red.	The unit has a problem. Check the Error Logger to read error message.
The ERR LED on the CPU module front panel 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.	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 CONF LED on the CPU module front panel is red.	There is a configuration error (such as an incompatible plug-in.) Check the Error Logger to read error.
The PWR LED on the CPU 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 PWR LED on the CPU 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 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. 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.

BREAK-FIX PROCEDURES

General

This chapter refers only to replacement of removable modules and plug-ins, not of other components of the unit. 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.

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 Module

Procedure 18-1 How to Replace a CPU Module

1. To replace a CPU module,
2. Open the door of the CPU module and press the cable holder downward.
3. Disconnect all cables from the connectors.
4. 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 18-1.

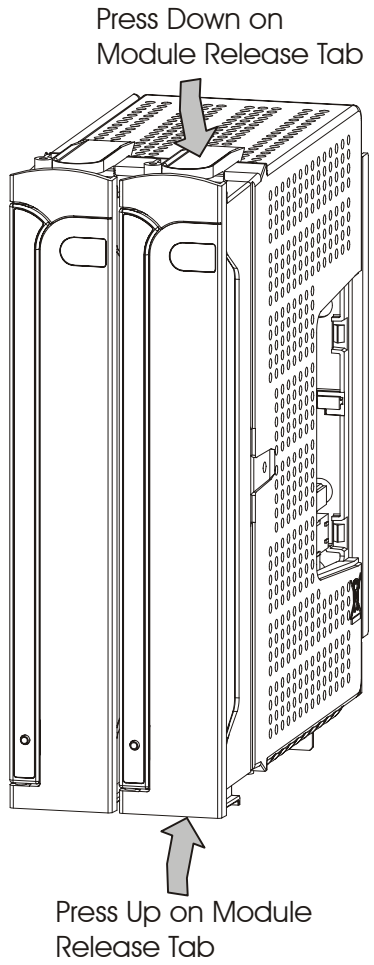


Figure 18-1 ACE3600 Module Release Tabs

5. Remove any SRAM plug-in memory from the old CPU module and plug in to the new CPU module.
6. Slide the new module all the way into the slot until the tabs click into place.
7. 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 18-2 How to Replace a Power Supply Module

1. To replace the second power supply module in a site with redundant power supplies,
2. Open the door of the power supply module and press the cable holder downward.
3. Disconnect the cables from the connectors.
4. 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.
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.
7. The main power supply cannot be removed under power and a safeguard is added in order to prevent unplanned removal. To replace the main power supply module,
8. Open the door of the power supply module.
9. 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.
10. Follow the instructions above for replacing a power supply module.

Replacing an I/O Module

Procedure 18-3 How to Replace an I/O Module

To replace an I/O module,

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 the TB extractor.
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. (DI, DO and Mixed I/O modules only.)
4. For DO relay modules, reset the 12VDO dipswitch, 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.

Replacing a Plug-in Port on the CPU Module

Procedure 18-4 How to Replace a Plug-in Port on the CPU Module

To replace a plug-in port on the CPU module,

1. 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 18-5 How to Replace a Plug-in SRAM Memory Card in the CPU Module

To replace an SRAM memory card on the CPU module,

1. 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

Procedure 18-6 How to Replace the Motherboard

To replace the motherboard of the ACE3600 RTU,

1. If the unit is installed in a NEMA4 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 18-2.

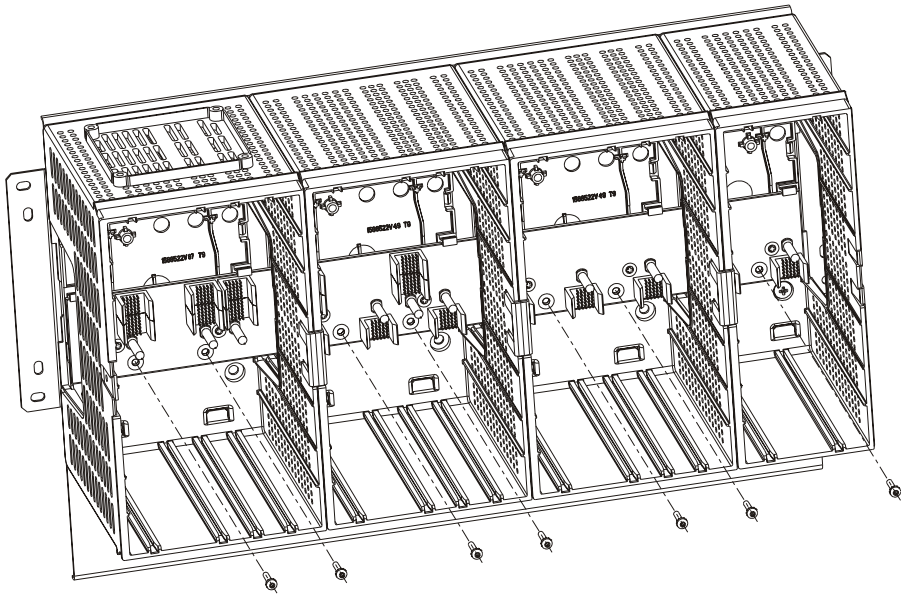


Figure 18-2 ACE3600 Motherboard on Metal Chassis

4. From inside the cage, push out the small cover on the side of the RTU rack/cage. Save the cover.
5. Slide the damaged motherboard out of the cage, through the opening on the side of the RTU rack/cage.
6. Slide the new motherboard into the rack, through the opening on the side of the RTU rack/cage.
7. Secure the motherboard to the rack/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 NEMA4 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

Procedure 18-7 How to Replace the Fuse for AUX1 1A/1B or AUX2 2A/2B

1. To replace a fuse for AUX1 1A/1B or AUX2 2A/2B on the power supply module,
2. Disconnect 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.
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. Using narrow pliers, remove the faulty fuse from its groove on the board.
5. Press the new fuse into the groove on the board.
6. Slide the power supply module all the way into the slot until the tabs click into place.
7. Reconnect 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.

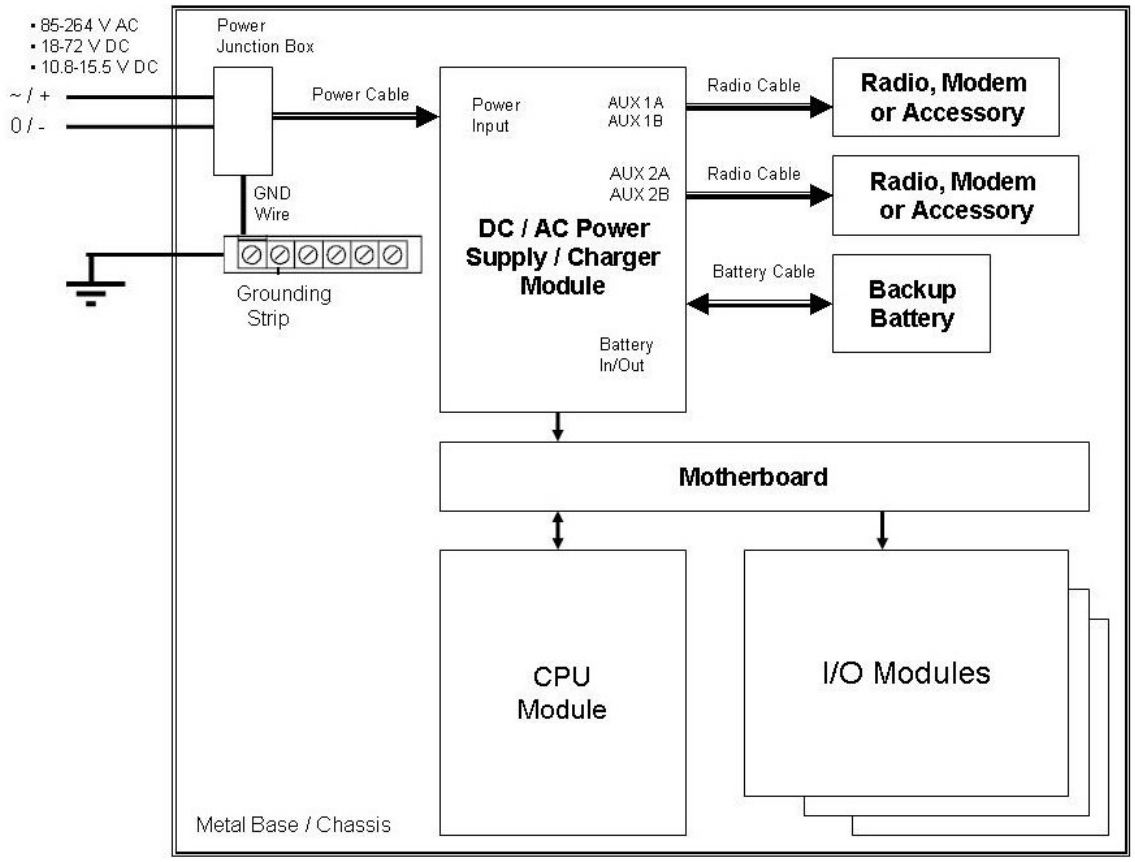


Figure 18-3 Electrical Interconnection (RTUs with I/O slots)

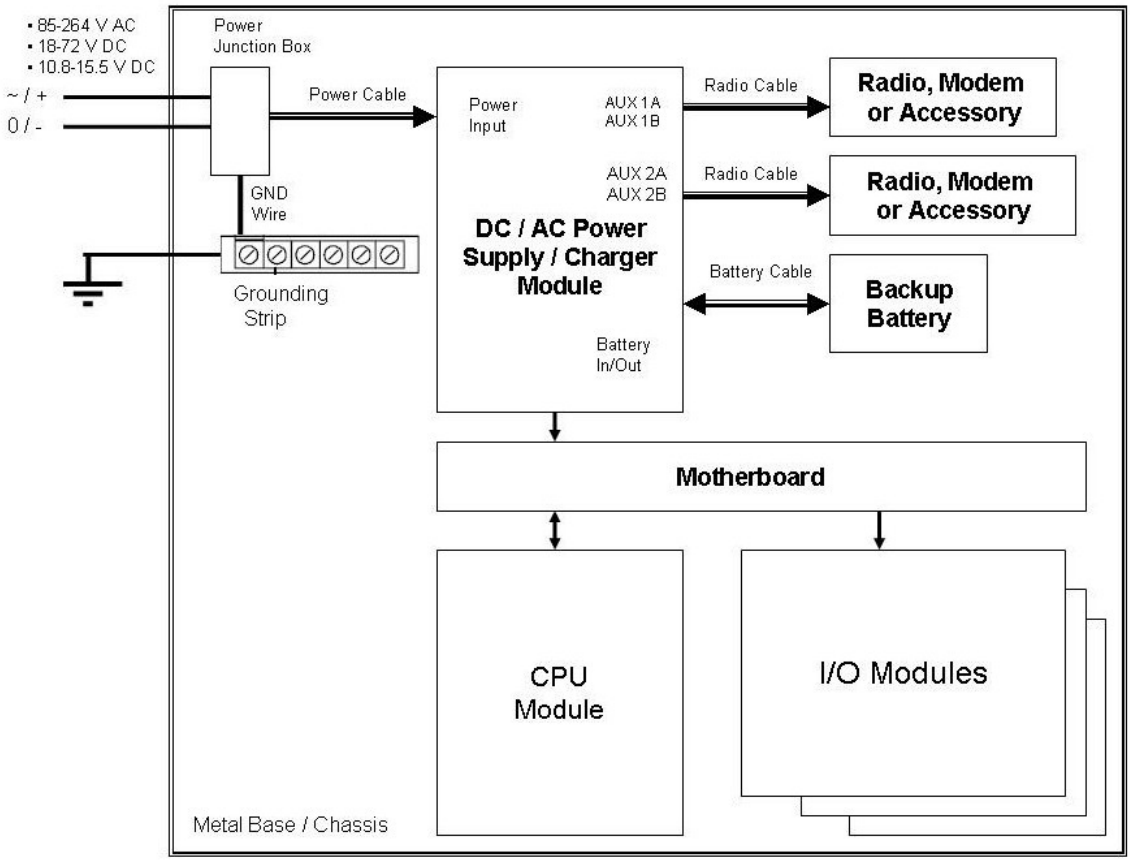


Figure 18-4 Electrical Interconnection (RTUs with no I/O slots)

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 244 x 198* mm (4.61" x 8.23" x 7.80"*), Weight: 0.95 Kg (2.1 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) * Depth including Module panel
Metal Chassis	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"*) Small - 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 (17.64" x 18.43" x 7.80"*) * Depth including Frame and Module

Enclosures	Large Nema 4X / IP65 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 4X / IP65 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	10.5-16 V DC (default) 18-72 V DC 18-72 V DC with 12V smart battery charger 85- 264 V AC, 50-60 Hz 85- 264 V AC, 50-60 Hz, with 12V smart battery charger
Backup Battery	6.5 Ah - Sealed Lead-Acid 10 Ah - Sealed Lead-Acid
Operating Temperature	-40 ºC to +70 ºC (-40 ºF to 158 ºF)
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

Regulatory Standards

Safety	UL 60950-1 (UL listed), CSA 22.2-950-1, EN60950-1, IEC 60950-1, AS/NZS 60950
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 Serial - up to 4 x RS232 ports Multi-drop – up to 3 x RS485 port Ethernet - up to 2 x 10/100 MB ports and 1 x 10 MB Two-way radio / analog trunked radio - up 2 x modem ports

Motorola Radio Support	Mobile two-way radios – CM 200 , CM 340, GM 3188, EM 200, CDM750 Portable two-way radios – HT750, GP320, GP328, PRO5150 Astro radios – XTL 5000 (digital and analog trunked) , XTS 2500 (digital trunked) Dimetra radios – MTM 800 (PD)
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 Protocols	Modbus RTU (Master/Slave, RS232/RS485), DF1 (Allan Bradley – Master RS232)
User Protocol (in user program)	Possible on RS232, RS485 and Ethernet ports

Specifications subject to change without notice.

APPENDIX B: ENVIRONMENTAL PROTECTION

Disposal of Components

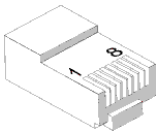
All components of the ACE3600 should be properly disposed of, in accordance with local regulatory standards and laws.

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 models which are equipped with an XTL5000 radio (F7523A/F7513A/F7524A/F7514A/F7585A/F7586A), or with a CDM750 radio (F7563A/F7564A)

APPENDIX C: RS232/RS485 ADAPTOR CABLES

General

Note: On all of the Motorola RJ45 connector heads, 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 (MDLC protocol)
- Connecting a User port to a printer
- Connecting a User port to an external unit
- Connection to a radio (MDLC protocol)
- RTU-to-RTU connection using MDLC protocol through RS232 ports (RS-Link)
- ACE3600 RTU-to-MOSCAD RTU connection using MDLC protocol through RS485 ports (RS-Link)

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

RS232 Function	8-pin Connector (on RTU)	25-pin Female	9-pin Female	Direction
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	-
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

RS232 Function	8-pin Connector(on RTU)	9-pin Male	Direction
GND	4	5	-
CD (Rec line)	5 ←	1	to RTU
RTS	6 →	4	from RTU
	7	Not used	
DTR	8 →	7	from RTU

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.

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-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 3089004V58 cable.

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