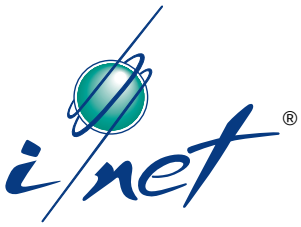

Installation Guide

Process Control Unit 7716

PCU 7716

for I/NET® Building Automation Systems

Control Systems International®

TCON096 — 01/99

We at Control Systems International (CSI) have tried to make the information contained in this manual as accurate and reliable as possible. Nevertheless, CSI disclaims any warranty of any kind, whether express or implied, as to any matter whatsoever relating to this manual, including without limitation the merchantability or fitness for any particular purpose.

CSI will, from time to time, revise the product(s) described in this manual and reserves the right to make such changes without obligation to notify the purchaser. In no event shall CSI be liable for any indirect, special, incidental, or consequential damages arising out of purchase or use of this manual or the information contained herein.

Printed in the United States of America.

Document Number: TCON096–01/99

About this manual:

This book was written and produced using FrameMaker workstation publishing software and the Minion font from Adobe. Illustrations were created or modified using Canvas.

Contents

FCC Warning

The Federal Communications Commission (FCC) requirements prescribe certification of personal computers and any interconnected peripherals in the FCC rules and regulations.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: this device may not cause harmful interference, and this device must accept any interference received, including interference that may cause undesired operation.

This equipment generates and uses radio frequency (rf) energy for its operation and, if not installed and used in accordance with the installation and operation manual, may cause interference to radio and television reception. It has been found to comply with the limits for a Class A computing device pursuant to the aforementioned regulations. These are designed to provide reasonable protection against such interference when operated in a residential area. Only peripherals (computer input/output devices) certified to comply with the Class A limits may be connected to this device. Operation with noncertified computer peripherals is likely to result in interference with radio and television reception. If this equipment does cause interference to radio or television reception, the user is encouraged to correct the situation by one or more of the following measures.

- Relocate the receiver with respect to the computer.
- Move the computer away from the receiver.
- Plug the equipment into a different outlet, so that the computing device and receiver are on different branch circuits.
- Disconnect and remove any unused cables that may be acting as a transmission source.
- Make certain that the computing device is plugged into a grounded outlet receptacle.

If necessary, contact CSI for additional suggestions.

Overview

The Model 7716 Process Control Unit (PCU) is a high-speed, fully distributed microprocessor-based controller used with the I/NET integrated network system. The 7716 is designed to connect directly to the controller LAN and works in conjunction with all other controllers and work stations on the I/NET 7700 LAN.

The 7716 supports over 200 addressable points, providing full adaptive Direct Digital Control (DDC), energy management, and process control in a single controller. The 7716 offers I/O expansion through five expansion modules.

The base 7716 controller is a single printed circuit board with a metal baseplate mounting. The baseplate provides keyhole mounting for easy installation within a CSI Universal Enclosure. All I/O connections to the 7716 are accomplished via plug-on terminal blocks.

Controller Board

The controller board (see Figure 1) measures approximately 9.00" × 8.50" (22.9 × 21.6 cm), the baseplate measures approximately 13.75" × 9.60" (34.9 × 24.4 cm).

Universal Enclosure

CSI's universal enclosures provides a protected environment in locations in which dirt, dust, or other contaminants may exist. CSI universal enclosures are available in several sizes and capacities designed to house various combinations of CSI control units and interfaces. The model used for the 7716 is the ENCL1813, measuring 18.2" H × 13.2" W × 4.2" D (46.2 × 33.5 × 10.7 cm).

The universal enclosure allows both door and back panel mounting, providing additional space for optional equipment such as transformers and electrical junction boxes. The enclosure includes a door key lock.

The 7716 board comes already mounted on a baseplate. That baseplate/PCB assembly is then mounted into the universal enclosure.

If the perforated backplane is used to mount the baseplates, then the size of the baseplates and the enclosure are the limiting factors. Baseplates vary in dimension depending upon the type of controller. All controllers or interface units are attached to a baseplate for mounting in a universal enclosure.

Power Supply

Electrical power connections for the 24 VAC input power are provided along the lower left side of the controller. The 7716 is powered from a single 24-volt AC, 40VA external transformer. The AC input provides power to five on-board supplies.

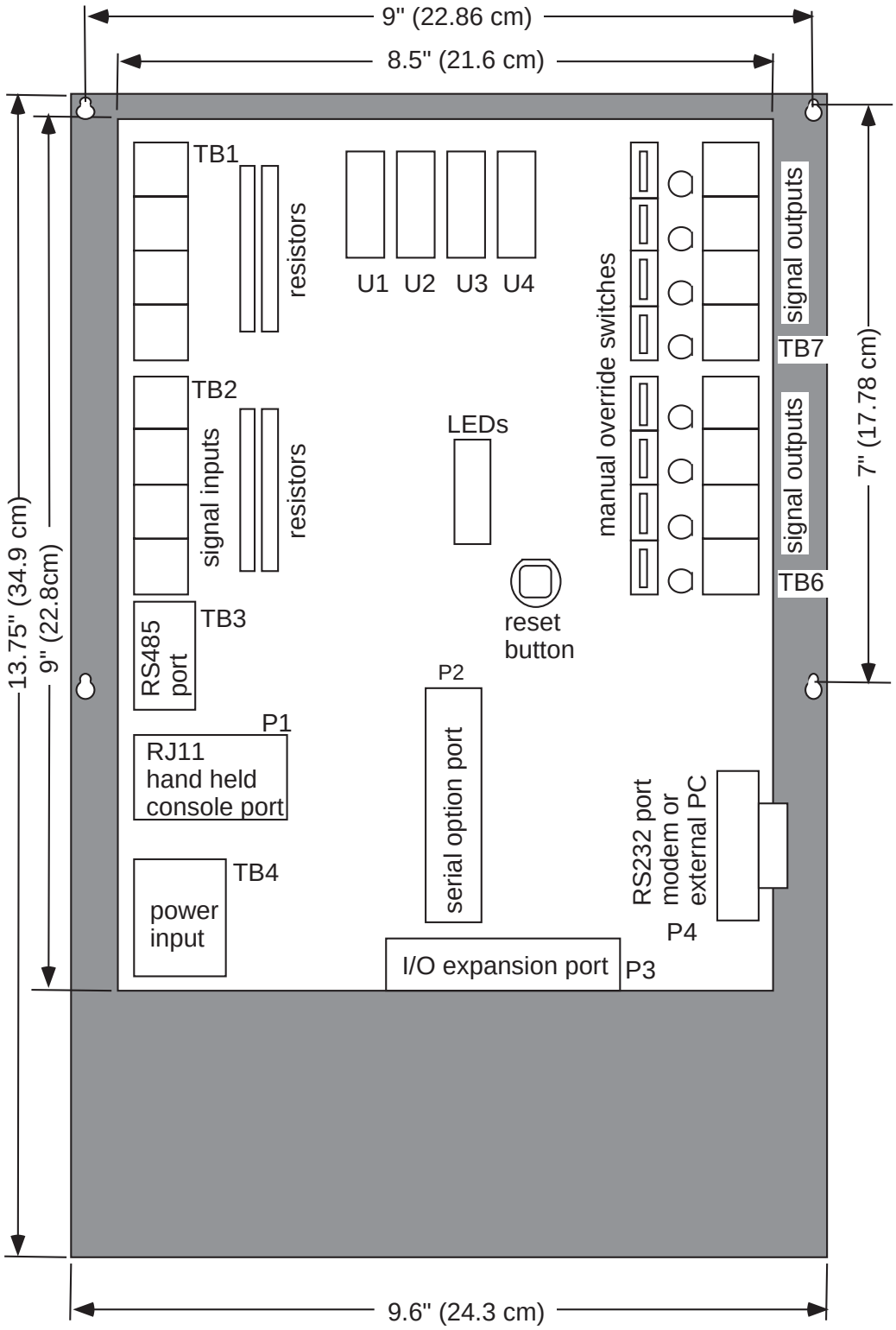

Figure 1. 7716 Motherboard and Baseplate

Table 1. Universal Enclosure Dimensions

Model	Panel Dimensions			Standard Door Mounting Baseplate Qty	Perforated Panel Backplane Dimensions		Panel Backplane w/Studs	Door Key Lock
	H	W	D		H	W		
ENCL1813 w/Knockouts and Gasketed Door	18.25" (46.2 cm)	13.25" (13.2 cm)	4.2" (10.7 cm)	1 – Any CSI baseplate unit	16.5" (41.9 cm) (#8–32 hardware Optional Panel mounting	12.5" (31.75 cm)	Mount one (max.) CSI baseplate unit Options: 1 – Transformer 1 – Junction box	Yes

- A switching power supply circuit is used to generate the +5 VDC logic power.
- Four linear power supplies are used to generate +15 VDC internal, +15 VDC external, –15 VDC and +24 VDC. The supply voltages are used for analog signal processing and RS232 communication.
- The separate +15 VDC (external) regulator is provided for supplying current loop excitation power to avoid loss of communication due to a field sensor wiring problem.

Power line frequency selection (50/60 Hz) is available from the DCU Configuration edit menu in I/NET.

Input/Output Terminals

The 7716's input and output terminals are located in different areas of the board. The inputs and outputs do not use the same number of terminals to make up a terminal set. See Figure 1 for terminal locations.

Input Terminations

Signal inputs are provided along the upper left side in two groups of four inputs. Three screw terminations are provided for each input (Signal, Ground and +15/24 V). The inputs (analog, discrete, or pulse) use point addresses 0000 through 0007.

Output Terminations

Output terminations are provided along the upper right side of the controller. The output terminations are arranged in two groups of four, with a single 12-pin plug-on terminal block for each group. Each output consists of a Form-C relay contact capable of handling 0.5 A (derated from 3 A) at 24 volts AC/DC. Each output provides discrete control of a field contact or a proportional control via pulse-width-modulation of the output contact. The outputs use point addresses 0000 through 0007.

Communication Ports

There are three communication ports on the 7716 board and an optional communication board that can be added as a plug-on daughterboard. All connections to the LAN, modems, external PCs and the Hand Held Console are made using these ports. See Figure 1 for port locations.

Serial Communication Port

The two asynchronous serial ports (on the 7716 baseboard) provide access to external PCs, external modems, and the HC7410.

Modem and PC Connection

The first asynchronous port (P4) provides an RS232 port for direct connection to a PC or external direct-dial modem. The RS232 port's baud rate is set using an HC7410.

Hand Held Console Connection

The second asynchronous port (P1) provides a modular TTL level interface to the standard HC7410 and operates at 1200 baud. An RJ11 modular jack is provided along the lower left side of the controller for connection of the HC7410.

LAN Communication Port

The LAN communication port (TB3) is located along the lower left side of the controller. A 3-pin terminal block provides connection of the RS485 shielded, twisted pair on the standard controller.

The normal speed of communication on the controller LAN is 19,200 BPS. The controller LAN speed can be lowered to 9600 baud using the HHC in order to accommodate lower grade cable installations.

Memory

The 7716 provides support for several types of memory with variable amounts of each. The memory is currently organized as follows:

Table 2. 7716 Memory

Socket	Amount	Memory Type
U4	32 KB	EPROM (Stores boot firmware)
U1, U2 and U3	96 KB	STATIC RAM (Stores download software and database. Memory is allocated dynamically.)

The 7716 also provides 256 bytes of serial nonvolatile RAM (NOVRAM) memory storage. This memory is used to hold all parameters necessary to establish basic communication with the controller after a long-term power outage (i.e., loss of RAM memory).

The software can be downloaded while the 7716 is on-line with I/NET. The software design and memory organization supports the complete download of all software, including revised LAN drivers which are invoked after completion of the download. The downloaded software is held in RAM.

When the 7716 is emulating a 78061 Tap, it can store the telephone numbers as a standard 78061 Tap would. Memory is sized to ensure accommodation of at least eight telephone numbers of at least twenty-five digits each.

Static RAM

The base unit configuration of the 7716 provides a minimum of 96 KB of battery-backed static RAM memory for software data storage and imbedded 7801, 78035 and 78061 Tap functions such as message queue, dial telephone numbers, and async/sync communication buffers.

Memory Exhaustion Warning

The PCU editors provide a warning message when the user adds a point or function that could exceed the available PCU memory.

Memory Management Unit (MMU)

This unit provides 20-bit addressing and one megabyte memory access.

Expansion Modules

The 7716 can be expanded by adding one or more expansion modules to the controller's expansion ports. The RS232 Serial Expansion Module connects at port P2, the other I/O expansion modules connect to the 7716 motherboard at port P3. Available I/O expansion modules include:

- UI/DO I/O Expansion Module in four variants
  - 4 Point UI/4 Point DO
  - 8 Point UI/8 Point DO
  - 8 Point UI
  - 8 Point DO
- 8 Point RTD I/O Expansion Module in two variants
  - 1000 Ohm platinum RTD
  - 100 Ohm platinum RTD
- 8 Point UI/4 Point AO Expansion Module (0–10 V)
  - Variant: 4 Point AO (0–10 V)
- 8 Point UI/4 Point AO Expansion Module (4–20 mA)
  - Variant: 4 Point AO (4–20 mA)
- RS232 Serial Expansion Module

The 8 Point UI/8 Point DO Expansion Module is described without the variants, since the difference between it and the variants is the absence of either the UI or DO points. Otherwise, operations for these three boards are the same.

UI/DO Expansion Module

The 7716 can control an additional eight relay outputs and eight inputs on an I/O expansion board that attaches to expansion port P3 at the lower end of the controller PCB. The input and output points on the UI/DO expansion board occupy point addresses 0100 through 0107.

The outputs are defined in the database as your choice of analog (PWM) or discrete outputs.

The inputs are shipped as 0–5 volt, but may be redefined on the expansion module by changing the resistors in resistor packs A, B, and C (refer to "Resistor Installation" on page -14). They are also defined in the database as analog, discrete or pulse.

UI/AO Expansion Module

The UI/AO Expansion Module provides the 7716 PCU with an additional eight universal inputs and four analog outputs. Depending upon the version, it will provide either four 0–10 volt or four 4–20 milliampere outputs. Variants also are available without the UI points and with the four AO points only.

The input points on the UI/AO Expansion Board occupy point addresses 0100 through 0107. The output points occupy point addresses 3100 through 3103.

Inputs are shipped as 0–5 volt inputs and may optionally be configured as current sensing or contact sensing by changing the resistors in resistor packs A, B, or C (refer to "Resistor Installation" on page -14). They are also defined in the database as analog, discrete or pulse.

RS232 Serial Expansion Module

The RS232 Serial Expansion Module provides a fourth serial interface. It provides a full complement of modem control, data and clock signals on an RS232 port. It provides two-way dial or dedicated line communication as currently supplied by CSI's 78061 or 78035 Tap. This interface supports user-selected data rates up to 19,200 BPS. This optional interface can be connected to the following devices:

- External auto-dial/auto-answer (AD/AA) modem — When connected to a Hayes-compatible AD/AA modem, the 7716 will provide the functionality of the 78061 Tap. The following types of modems are supported:
  - Synchronous — Use a synchronous modem when the controller is loaded with an I/NET version 4.x or earlier binary file. The controller must also have I/NET version 4.x boot firmware (EPROM).
  - Asynchronous — Use an asynchronous modem when the controller is loaded with an I/NET 2000 binary file. The controller must also have I/NET 2000 boot firmware (EPROM).

Note: *Ensure that all AD/AA Taps within your I/NET system are configured to use the same communication protocol — either synchronous, or asynchronous. Mixing AD/AA protocols will cause communication errors.*

I/NET 2000 is compatible with I/NET version 4.x Tap and controller binary loads. Therefore, when synchronous AD/AA communication is required on an I/NET 2000 system (for example, when using a 78040, 78050, or 78060 Tap), you must continue to use I/NET version 4.x Tap and controller binary loads.

- External synchronous dedicated line modem — When connected to an external Hayes-compatible dedicated line modem, the 7716 provides the functionality of a CSI 78035 Tap.
- Another RS232 data communication device.

Installation Procedures

Use the following steps to install the 7716 baseboard. This procedure allows you to set up the 7716 with the proper DCU address, perform a field checkout on the hardware, set Tap emulation, Baud rate and controller LAN baud rate.

1. Disconnect power.
2. Disconnect power to all devices that will be connected to the 7716 PCU.

Warning: *Failure to disconnect power from all interconnected equipment when performing electrical installation may result in electrical shock or burns.*

3. Mount universal enclosure on a wall.
4. Bring conduit into box (conduit contains power, sensor cables, etc.)
5. Attach the baseplate (and its attached motherboard PCB) into the universal enclosure box (keyhole mount).

Basic 7716 unit	Four screws support the baseplate and motherboard combination.
Unit with expansion board	Attach the expansion board to the motherboard, then fasten the expansion board's five screws to the baseplate.
Unit with optional RS232 board	Insert the RS232 onto the 7716 PCB base unit at P2 port.

6. Terminate wires at PCB. (Details in this section.)
7. Connect the modem or external PC.
8. Connect the power supply to the 7716. Remember to set the power line frequency (50/60 Hz) using "Setting the Power Line Frequency" on page -22.
9. Reconnect power to devices that are connected to the 7716 PCU.
10. Perform field checkout. (Refer to "Field Hardware Checkout and Addressing" on page 36.)

Connecting an Expansion Module Board

Connect port P1 on the option board to port P3 on the bottom of the 7716 PCU. Mount this option board to the baseplate with the five screws provided. The inputs and outputs are connected using the same procedures as outlined below for the basic 7716 unit.

Installing the Input Field Connections

The 7716 supports several types of inputs, each using different field connections. Use the procedures shown below to connect the sensors you use to the 7716. The illustrations and procedures describe connection to the 7716 PCU. Connections to an expansion board are the same for like types of inputs and outputs.

Caution: *The input, output and power wiring must be routed along the side of the controller. The wiring must not lay across the controller.*

Refer to "Resistor Installation" on page -14, to determine the correct resistor configuration for your inputs.

Installing Supervised Field Inputs

Supervision may be accomplished on a single Normally Open or Normally Closed contact, or on multiple Normally Open contacts connected in parallel. The contacts may be supervised for line cuts by using a single resistor connected in parallel with the contact. If additional supervision for line shorts is desired, an additional resistor connected in series with the contact may be used. The resistor value for either shall be 1 K ohm, $^1/_4$ watt, ±5%, or 1 K ohm, $^1/_4$ watt, ±1%. The Resident I/O editor of the I/NET host must be configured for either single resistor supervision, or two resistor supervision. See Figure 2 and Figure 3.

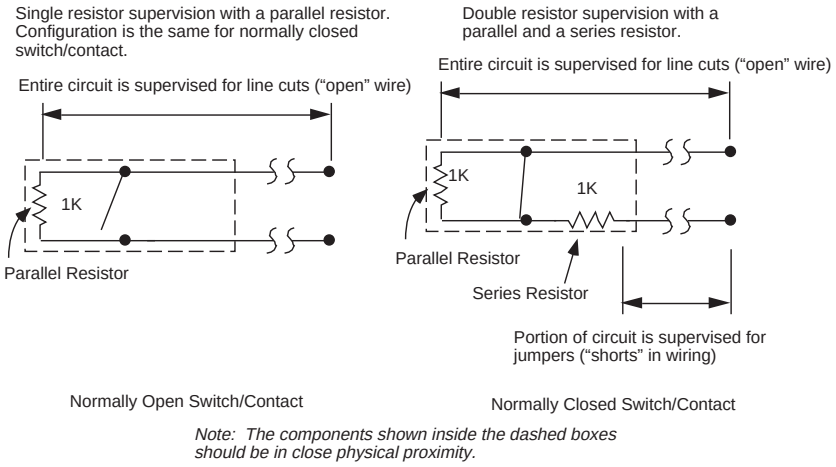

Figure 2. Supervised Single Switches/Contacts

Multiple switches or contacts connected to a supervised input (see Figure 3) must consist of normally open switches or contacts wired in parallel.

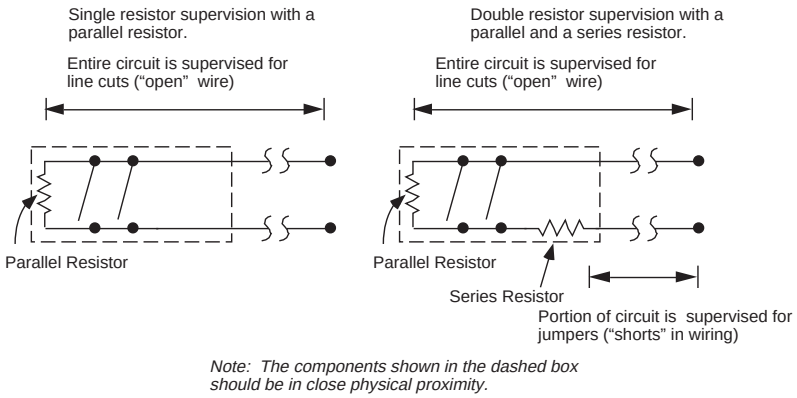

Figure 3. Supervised Multiple Switches/Contacts

Connecting Lini-Temp Inputs

Signal inputs are provided along the upper left side in two groups of four inputs. Three screw terminations are provided for each input (Signal, Ground and +15/24 V) as shown in Figure 4. The LTS80 temperature sensors can be connected in a 2-wire or 3-wire configuration as shown in Figure 4. Refer to “Resistor Installation” on page -14 for resistor configuration. The 3-wire configuration does not require a resistor. See Figure 11 on page -15.

1. Connect the white lead to a signal (UI-x) terminal on TB1 or TB2.
2. Connect the orange lead to the +V terminal of the input set.
3. For 3-wire sensors, connect the blue lead to the GND terminal (see Figure 4).

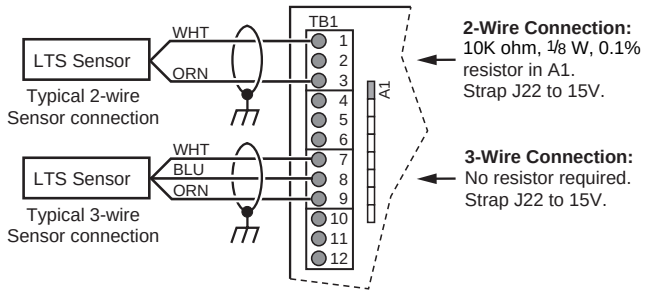

Figure 4. Lini-Temp Input Sensor Connections

4. When using a 2-wire sensor configuration, place a 10K, $^1/_8$ W, 0.1% resistor in the corresponding resistor “A” position.
5. Ensure that the variable voltage selection is set on J22 of the 7716 to +15 V (refer to “Variable Voltage Selection” on page -13).
6. On the UI/DO Expansion board select the voltage by positioning jumper J1 (refer to “Variable Voltage Selection” on page -13).

Thermistors

If you are using a 10K ohm thermistor instead of an LTS sensor, connect the thermistor to TB1 or TB2 on the 7716 base card. If using a UI/AO expansion module connect to TBX1. If using a UI/DO expansion module connect to TBX1 or TBX4. Refer to "Resistor Installation" on page -14 for resistor configuration. See Figure 11 on page -15 for resistor installation.

1. Connect one lead of the thermistor to the desired input terminal.
2. Connect the other lead to the ground terminal (see Figure 5).

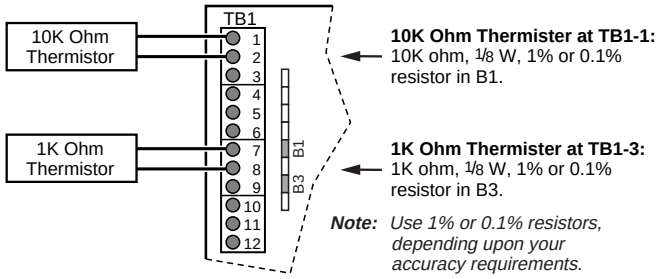

Figure 5. Thermistor Connection

0–20 and 4–20 Milliampere Sensors

0–20 and 4–20 milliampere sensors can be connected as shown in Figure 6. Refer to "Resistor Installation" on page -14 for resistor configuration. See Figure 11 on page -15 for resistor installation.

1. Connect the output lead from the sensor to a SIGNAL terminal on TB1 or TB2.
2. Connect the input lead of the sensor to the +V terminal of the input set.
3. Ensure that the variable voltage selection is set on J22 of the 7716 to the appropriate voltage (refer to "Variable Voltage Selection" on page -13).
4. On the UI/DO expansion board select the voltage by positioning jumper J1. On the UI/AO expansion board position jumper J5 (refer to "Variable Voltage Selection" on page -13).

If more than eight 0–20 mA sensors are connected, or if more than eight 0–20 or 4–20 mA sensors are connected in any combination, use an external power supply and connect as described below.

1. Connect the output (–) lead from the sensor to SIGNAL terminal on TB1 or TB2.
2. Connect the input (+) lead from the sensor to the positive (+) terminal of the external power supply.
3. Connect the negative (–) terminal of the external power supply to the GND terminal (see Figure 6).
4. Install a 249 Ohm, $^{1}/_{8}$ W, 0.1% resistor in the corresponding resistor "A" position.

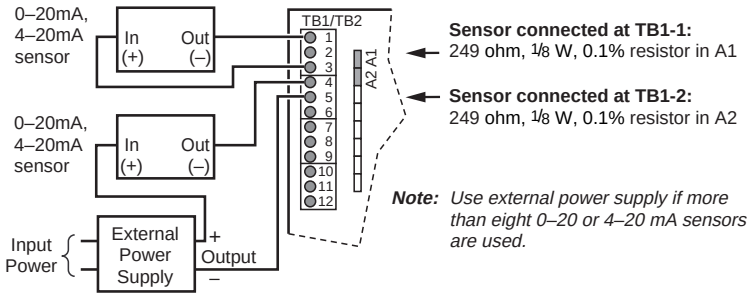

Figure 6. 0–20 and 4–20 Sensor Connections

0–10 V Sensor Connection

A 0–10 V sensor uses three leads to connect to an expansion board. Refer to "Resistor Installation" on page -14 for resistor configuration. Connection is identical for the 7716 and UI/DO, and UI/AO Expansion Boards.

1. Connect the out lead of the 0–10 V sensor to a signal (UI-x) terminal.
2. Connect the negative lead of the sensor to the GND terminal of the 7716.
3. Connect the +V lead of the sensor to the +V terminal on the 7716 (see Figure 7).

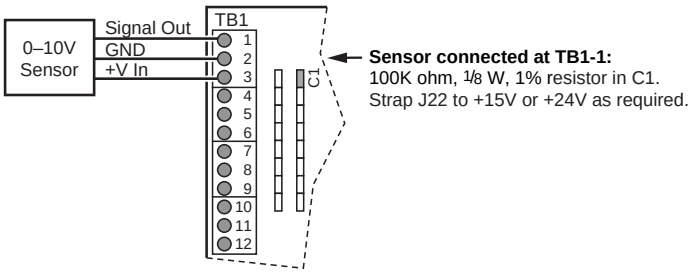

Figure 7. 0–10 Volt Sensor Connections

4. Install a 100K Ohm, $^1/_8$ W, 1% resistor in the corresponding resistor "C" position.
5. Ensure that the variable voltage selection is set on J22 of the 7716 to the appropriate voltage (refer to "Variable Voltage Selection" on page -13).
6. On the UI/DO Expansion board, select the voltage by positioning jumper J5 (refer to "Variable Voltage Selection" on page -13).

RTD Sensor Connection

Versions of the RTD Expansion Module support either eight standard 1000 ohm or 100 ohm RTD devices. While the RTD Expansion Module can be wired using 2-wire connection, more accurate temperature measurement is gained using the 3-wire mode. Connect the RTD sensors to TBX1 and TBX2 using the three terminals provided for each RTD circuit (see Figure 8).

1. Connect the RTD drive lead to the DRV connection.
2. Connect the Sense lead to the numbered terminal (1–4 on TBX1 and 5–6 on TBX2).

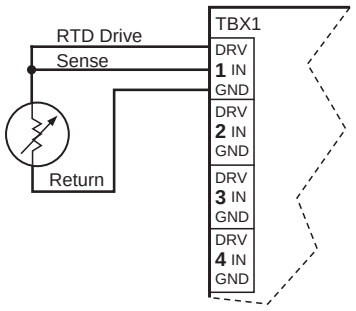

Figure 8. RTD Sensor Connections

3. Connect the Return lead to the GND terminal.

Connecting Discrete Input Points

For contact sensing on the 7716 PCU or the UI/DO Expansion Board, either DI or PI, the excitation current for the field contact is achieved by placing a 1K ohm, $^1/_4$ W, 5% resistor in the appropriately numbered "B" position. The "B" position provides a pull-up on the input to 5 volts DC for dry contact excitation. On the UI/AO Expansion board, the resistor also goes into the "B" position, and you must also position a jumper on J6 to supply the +5 V pull-up.

1. Connect one lead from the contact to the signal (UI-x) terminal.
2. Connect the other lead of the sensor to the GND terminal of the 7716 (see Figure 9).
3. Install a 1K Ohm, $^1/_4$ W, 5% resistor in the corresponding resistor "B" position.
4. On the UI/AO Expansion board, position a jumper on J6 to supply the +5 V pull-up and install the resistor in the "B" position.

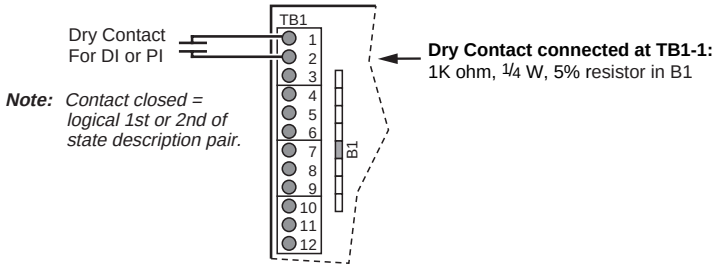

Figure 9. Dry Contact Connections

Variable Voltage Selection

You may select either +15 or +24 volt power provided by the 7716 PCU to a connected sensor by positioning a jumper on J22 (see Figure 19 on page -20). To achieve +15 volts, position the jumper on posts B and C. Position the jumper on posts A and B to achieve +24 volts. Refer to Table 3 for details.

You may select either +15 or +24 volt power provided by the UI/DO by positioning a jumper on J1 (see Figure 26 on page -28). To achieve +15 volts, position the jumper on the top and middle posts. Position the jumper on the bottom and middle posts to achieve +24 volts.

On the UI/AO you may select either +15 or +24 volt power provided by the UI/AO by positioning a jumper on J5 (see Figure 27 on page -29). To achieve +15 volts, position the jumper on the left and middle posts. Position the jumper on the right and middle posts to achieve +24 volts.

Jumper J6 is used on the UI/AO expansion board to select the pull-up voltage used by the "B" resistor positions. When using J6 the pull-up voltage may be set to 5 V (default setting) or 15 V. The 15 V position can be used to alter range and resolution when connecting resistive input devices.

Table 3. Variable Voltage Selection

PCU or Expansion Board	Jumper	+15	+24
7716	J22	B to C	A to B
UI/DO	J1	Top to Middle	Middle to Bottom
UI/AO	J5	Left to Middle	Middle to Right
PCU or Expansion Board	**Jumper**	**5 V Pull Up**	**15 V Pull UP**
UI/AO	J6	5 V to Middle	Middle to 15 V

Note: *The available 160 mA at +V (either +15 or +24 VDC) applies to the expansion boards also. The combined current drain for base inputs and expansion inputs cannot exceed 160 mA total when using the on-board supply.*

Resistor Installation

The eight inputs on the UI/DO, UI/AO card and the 7716 PCU baseboard are shipped in a 0–5 volt configuration. You may configure the inputs by placing resistors in the appropriate plug-in position for each input. These positions are labeled A1 through A8, A1 corresponding to input UI-1 and A8 to UI-8. Alternate positions labeled B, C and D are also provided (see Figure 10). The "A" positions provide a pull-down to DC ground on the input signal for analog input current sensing. The "B" positions provide a pull-up on the input to 5 volts DC for excitation of discrete contact inputs. The "C" positions allow you to configure for 0–10 volt inputs. The "D" positions are not used.

To configure an input for a 10K ohm thermistor, insert a 10K ohm, $^1/_4$ W, 1% or 0.1% resistor in the corresponding "B" resistor position (1B through 8B). The position numbers (1B–8B) correspond to the inputs 1 through 8 (see Figure 11). For a 1K ohm thermistor, insert a 10K ohm, $^1/_4$ W, 1% or 0.1% resistor in the corresponding "B" resistor position.

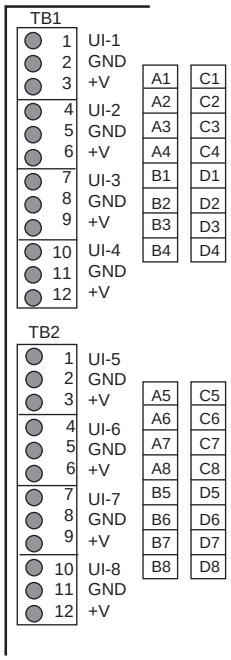

Figure 10. Input Configuration Resistors

Note: *You may use a 1% or a 0.1% resistor, depending upon your accuracy requirements.*

In order to configure an input for 0–20 mA, insert a 249 ohm $^1/_8$ W, 0.1% current sensing resistor in the corresponding resistor position (1A through 8A). The position numbers (1A–8A) correspond to the inputs 1 through 8 (see Figure 11). For 2-wire Lini-Temp, install a 10K Ohm $^1/_8$W, 0.1% resistor in an "A" position. For 0–10 V, install a 100K Ohm, $^1/_8$ W, 1% resistor in a "C" position. Dry contact inputs (DI or PI) require a 1K Ohm, $^1/_8$ W, 5% resistor in a "B" position. See Figure 11 for details of installation.

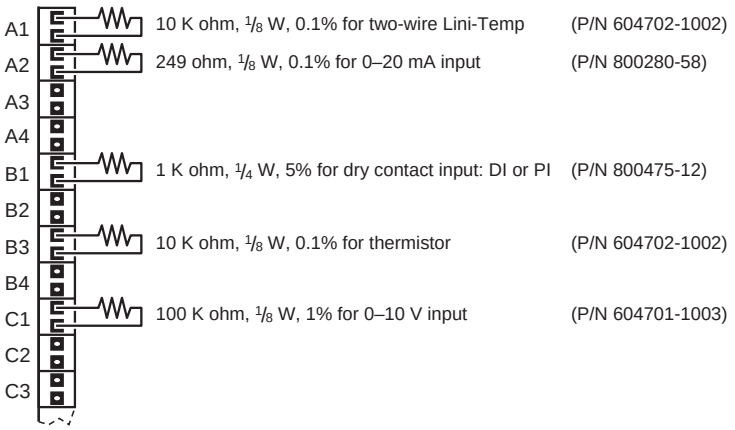

Figure 11. Resistor Installation

Installing the Output Field Connections

Output terminations are provided along the upper right side of the controller (see Figure 12). Each output consists of a Form-C relay contact capable of handling 0.5 A at 24 volts AC/DC. Each output provides discrete control of a field contactor or a proportional control via pulse-width-modulation of the output contact.

Universal or Discrete Output Connection

When connecting a device, first determine whether it is normally open or normally closed. Connect one wire to the middle terminal of the set (numbered 1 through 8) and one wire to the terminal designated NO or NC (see Figure 12).

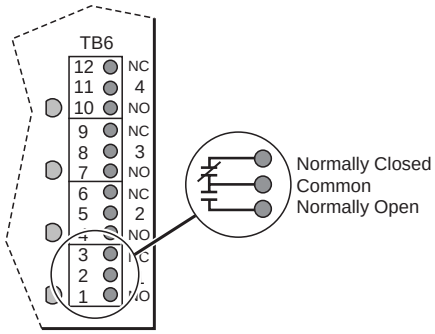

Figure 12. Output Terminal Locations

1. Connect one lead from the device to the desired NO or NC terminal.
2. Connect the other lead to the Common terminal on the 7716 or expansion board.

Analog Output Connection

When connecting an analog device to a UI/AO board, connect one lead to the signal input (AO-x) terminal and the other lead to the GND terminal (see Figure 13).

1. Connect one lead from the device to the desired AO-x terminal.
2. Connect the other lead to the GND terminal on the expansion board.

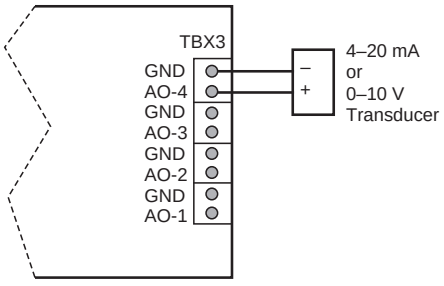

Figure 13. Connecting Analog Output

Connecting the Hand Held Console

This asynchronous port (P1) provides a modular TTL level interface to a HC7410 and operates at 1200 baud (see Figure 14).

Connect the hand held console cord into the RJ11 jack on the base unit PCB.

The console can then be attached to the inside of the Universal Enclosure by pressing the Velcro® tab on the back of the console to the Velcro tab on the inside of the enclosure.

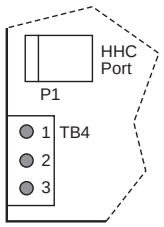

Figure 14. HC7410 Connection

Connecting the LAN

The LAN port is located along the lower left side of the controller. It provides synchronous SDLC communication and supports the primary RS485 Controller LAN connection.

A five-pin terminal block provides connection of the RS485 shielded, twisted-pair cable (see Figure 15).

1. Connect the Com + line to terminal 1.
2. Connect the Com – line to terminal 2.
3. Terminal pins 3, 4, and 5 are not used.

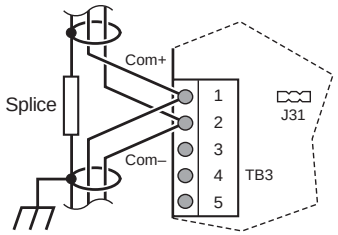

Figure 15. LAN Connections

Note: *This procedure applies to all LAN connections.*

- Ensure that the LAN cable shield drain wire is **not** connected to the controller LAN terminal block.

- Shield drain wire continuity must be maintained as the LAN cable passes through each controller. Shield drain wires from each controller LAN cable must be twisted together, insulated, and tied back such that wires do not come in contact with ground or any conductive surface within a controller.
- Connect the shield drain wire directly to Electrical Service Earth Ground at **only** one end of the cable (e.g., at the MCI, MRI, DPI, or controller).

Connecting an External PC

Port P4, with its 9-conductor D-Subminiature connector, provides asynchronous communication and is used to support the direct connection of a PC. This connector provides the circuit connections typical of the serial COM port on the PC.

CSI provides two cables to connect the 7716 to a PC. Use CSI cable number CBL072 for a 9-pin PC connection, and CSI cable number CBL073 for a 25-pin PC connection (see Figure 16). A six-foot (1.82 m) serial PC communication cable with a low-profile, right-angle D-Sub connection can be obtained from CSI. Connect the right-angle connection end to the controller and the hood end to the PC.

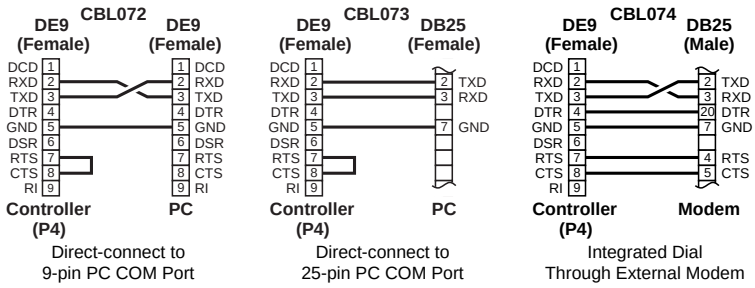

Figure 16. RS232 Port at P4

When the 7716 is connected directly to a PC, the 7716 performs the functions of a 7801 Tap without consuming a second LAN address.

1. Connect the cable from the PC COM 1 or COM 2 port to this port on the 7716 base unit PCB.
2. Set the PC port baud rate on the 7716 to 9,600 BPS using an HHC 7410. Refer to "Setting the Tap Baud Rate" on page -21.

Connecting the Modem

This port provides a nine-conductor D-Subminiature connector. When the 7716 is connected to a Hayes-compatible modem, the current "Integrated Dial" function (i.e. one-way dial from the host PC to the controller LAN) is provided. CSI cable number CBL074 is available from CSI.

1. Connect the modem to port P4.
2. Set the baud rate (typically 2400) via a standard HC7410. Refer to "Setting the Tap Baud Rate" on page -21.

Installing the Optional RS232 Serial Interface Board

Warning: *Ensure that no power is connected to the 7716 when performing this procedure. Failure to disconnect power from all interconnected equipment when performing electrical installation may result in damage to the components, electrical shock, or burns.*

After all connections (except power supply) are made to the base unit PCB, install this card on P2, the serial option port (see Figure 17).

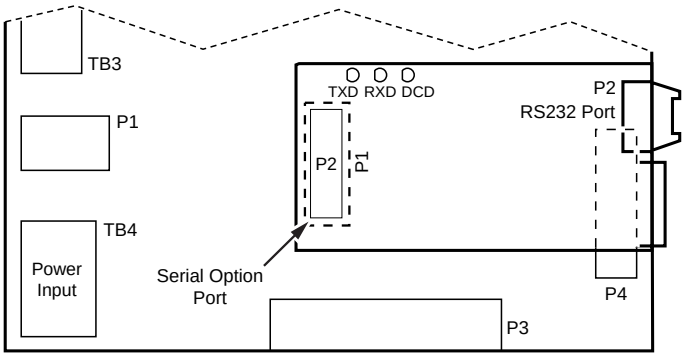

Figure 17. RS232 Serial Interface Board Connection

Connecting the Power Supply

Warning: *Ensure that no power is connected to the 7716 when performing this procedure. Failure to disconnect power from all interconnected equipment when performing electrical installation may result in damage to the components and/or electrical shock or burns.*

Electrical power connections for the 24 VAC input power are provided along the lower left side of the controller (see Figure 18).

Caution: *Do not connect the 3-point 24 VAC connector to the LAN connector at TB3. This will cause damage to the LAN port!*

1. Connect the 24 VAC input leads from a separate, isolated 24 VAC/40 VA transformer to terminals 1 and 2 of terminal block TB4.
2. Connect terminal 3 of TB4 to a good earth ground (using 14–18 AWG wire).

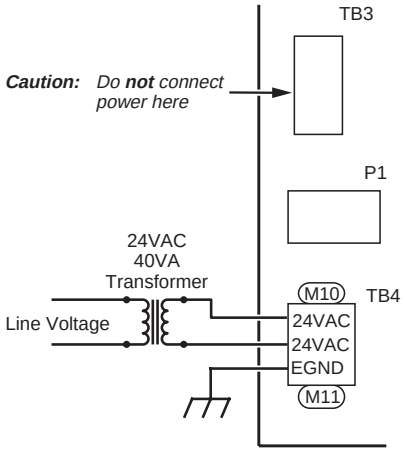

Figure 18. Power Connections

Set Up and Operation

This chapter describes the various components of the 7716. This unit mounts indoors on a wall surface in an area that meets the specifications outlined (refer to "Specifications" on page 46). You should set the unit's address after first powering up the unit and prior to connection to the controller LAN. Identify and record input and output terminals and addresses with their physical terminal block and pin numbers. Also, identify the devices to which they connect. Write this information on a copy of the "Pinout Chart" on page -43 of this Installation Guide.

The locations of major items involved in a typical installation are shown in Figure 19.

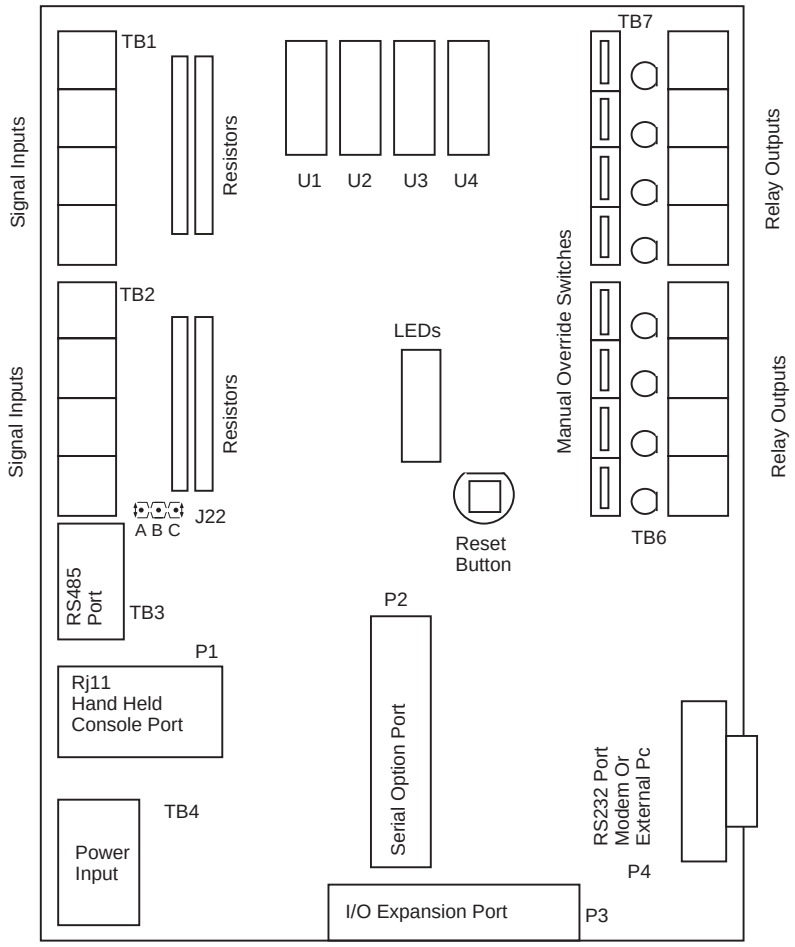

Figure 19. Component Location

Set Up Using the HC7410

The following procedures let you to enter the setup parameters that allows the 7716 to communicate and operate.

Setting the 7716 PCU Address

1. Connect the Model 7410 Hand Held Console and set the 7716's LAN address. Press [**DCU ADDR**]. The current 7716 address displays in the two right-most digits of the HHC display.
2. Enter the desired address using the numeric keys. The address displays as it is entered.
3. Press [**Enter**]. The 7716 RAM is updated with the new address.

Setting the Tap Emulation

1. Press [**Code**].
2. Press **90** and then press [**Enter**]. The emulated device type model number displays in the readout.
3. Press [**Inc**] or [**Dec**] to toggle through 7801, 7803 or 7806 Tap emulation. Refer to Table 4 for Tap emulation as it appears on the HC7410.

Table 4. HC7410 Tap Emulation Selection

Tap Model	HC7410 Display
No Tap Emulation	771600
7801	771601
78035	771603
78061	771606

4. Press [**Enter**] to accept your choice.

Setting the Tap Baud Rate

1. Press [**Code**].
2. Enter **91** and then press [**Enter**] to set the Tap baud rate.
3. Press [**Inc**] or [**Dec**] to toggle through the available PC port baud rates, typically 9600.
4. Press [**Enter**] to accept your choice.

Setting the Controller LAN Baud Rate

1. Press [**Code**].
2. Enter **6** and then press [**Enter**] to set the controller LAN baud rate.
3. Press [**Inc**] or [**Dec**] to toggle between 9600 baud and 19.2 Kbaud rates.
4. Press [**Enter**] to accept your choice.

Setting the Power Line Frequency

Warning: *Ensure that no power is connected to the 7716 when performing these procedures. Failure to disconnect power from all interconnected equipment when performing electrical installation may result in damage to the components, electrical shock, or burns.*

1. Press [**Code**].
2. Enter **92** and then press [**Enter**] to select the AC line frequency.
3. Press [**Inc**] or [**Dec**] to switch between 50 and 60 Hz.
4. Press [**Enter**] to accept your choice.
5. Connect the 7716 to the LAN.
6. Program the PCU from the host PC. (Details in the *I/NET Operator Guide*).

Hardware Inputs

The 7716 provides eight universal inputs on the base card. These inputs can be defined in the database as analog inputs (AI), discrete inputs (DI), or pulse inputs (PI).

Note: *Inputs may be defined as AI, DI or PI, but only one type can be defined for a specific point.*

As discrete and pulse inputs are scanned, points are tested for a value above or below a 25/75% threshold to determine if the device is an open or closed contact.

- Closed contact: A value below 25% scale (1024) is considered a closed contact.
- Open contact: A value above 75% scale (3072) is considered an open contact.

Analog, discrete, or pulse inputs occupy point addresses 0000 through 0007 (see Figure 20). The same point number identifies an input point, regardless of its type.

All inputs on the base card are equipped with transient suppression components. The analog input multiplexer will withstand input voltages up to 15 VDC (on-board analog excitation voltage).

Power line frequency selection (50/60 Hz) is changed using the HC7410. Refer to "Setting the Power Line Frequency" on page -22.

The 7716 provides a median value filter, as well as a 50/60 Hz notch filter, to reduce/eliminate random electrical noise, which normally shows up as extraordinarily high/low readings on the input.

Look-Up Tables

The 7716 PCU allows you to define up to thirty-two look-up tables, each containing twenty-one points. You may use these look-up tables to create engineering units, create sensor limits, or focus resolution on an interval span of interest that you define.

For instance, after you establish the upper and lower limits of the sensor for the lookup table, you can populate the remaining points in the table within a limited area. The area you populate with points can be grouped closely together to provide increased resolution within that span.

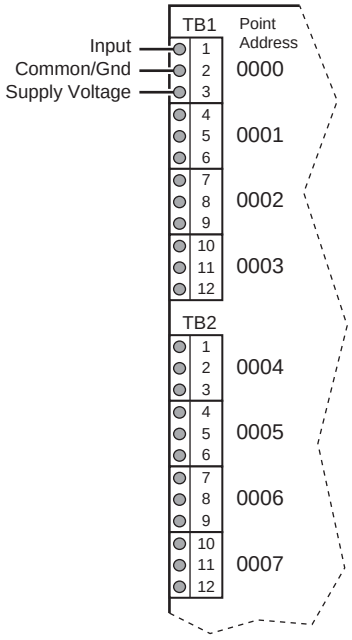

Figure 20. Universal Input Points and Addresses

You may also use the lookup tables to limit the sensor's boundaries within the accuracy range of the sensor, as with a flow sensor. The look-up tables can be used with linear or non-linear sensors, and can be used with integer or non-integer numbers, and uni-polar and bi-polar entries. Refer to the Controller Configuration chapter in any of the following documents for more information:

- TCON094, *I/NET Operator Guide (DOS)*
- TCON145, *I/NET Technical Reference Guide*
- TCON209, *I/NET 2000 Technical Reference Guide*

Selecting Input Type

The eight inputs on the base card are shipped in a 0–5 volt configuration. The inputs may be configured by placing resistors in the appropriate plug-in positions for each input. The PCU-7716 and its expansion boards must be configured with plug-in resistor for the following sensors.

- 2-Wire Lini-Temp
- 0–20 mA and 4–20 mA
- 0–10 V
- Contact sensing discrete inputs and pulse inputs

Refer to "Resistor Installation" on page 14 for instructions on resistor configurations for each type of input.

You may select whether to provide +15 or +24 volts, with a maximum load of 160 mA, to sensors connected to the 7716 PCU. When using Lini-Temps and 0–20 mA sensors that require 24V, or if more than eight 0–20 mA sensors are used, an external power supply must be used. Refer to "Variable Voltage Selection" on page -13 for the procedure.

Control Outputs

Eight relay outputs are provided on the base controller. Each output provides a single Form-C contact with a derated current capacity of 0.5 A. These occupy the point address range of 0000 to 0007.

Output Terminals

The outputs are terminated via two twelve-position plug-on terminal blocks (TB6 and TB7). An LED indicator adjacent to each output relay is illuminated when the relay is energized (see Figure 21).

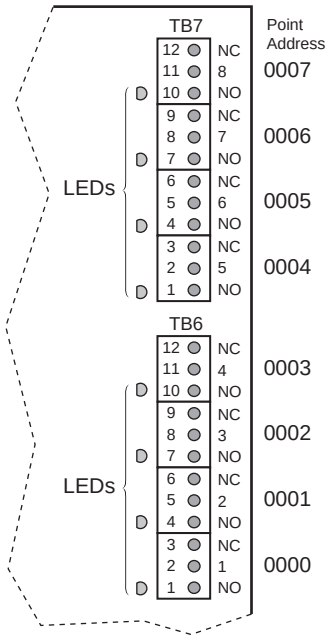

Figure 21. Output Terminal LEDs

Manual Override

Manual override switches (HOA switches) are provided for each output. In addition, they provide discrete input feedback of the switch status (see Figure 22).

In the normal center position, these permit the software to automatically control the devices attached to the outputs. You can manually place a switch in either the On or Off position for maintenance or test purposes. When a switch is in On or Off position, the software provides an alert indicating that someone has put that point into manual override (see Figure 23).

Note: *The switch On/Off position corresponds to the state of the relay. The actual state of the controlled environment depends on the contacts used on the Form-C output.*

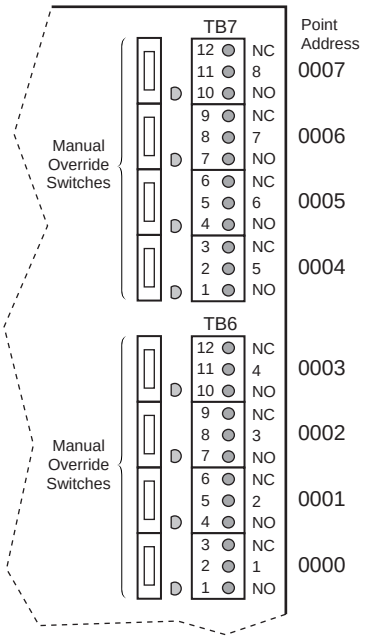

Figure 22. Manual Override (HOA Switches)

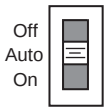

Figure 23. HOA Switch Positions

Two status bits (DI points) are returned from each switch. When in the Auto position, both DI points will indicate an open contact. The 16 feedback status bits will be mapped into the system on bit offsets 8 and 9 of point address 00–07 (Bit 8 set to 1 indicates Manual On, or an energized output relay. Bit 9 set to 1 indicates Manual Off, or a deenergized output relay.). The first Bit in the pair will indicate a closed contact when the switch is placed in the On position. The second Bit will indicate a closed contact when the switch is placed in the Off position.

Communication Ports

There are three communication ports on the 7716 board, and an optional RS232 communication board that can be added as a plug-on daughterboard. All connections to the LAN, modems, external PCs and the Hand Held Console are made using these ports. See Figure 1 on page -2 for port locations.

The two asynchronous serial ports (on the base 7716 board) provide access to external PCs, external modems, and the HC7410. The RS485 port provides connection for the I/NET controller LAN, while the RS232 serial connection allows connection to a modem, or a direct connect to an I/NET host PC. Refer to *Installation Procedures<Default Font>* for instructions on connecting each of these communication ports.

LEDs

The 7716 provides a bank of ten communication LEDs (see Figure 24) that show the status of communication in the controller and other information.

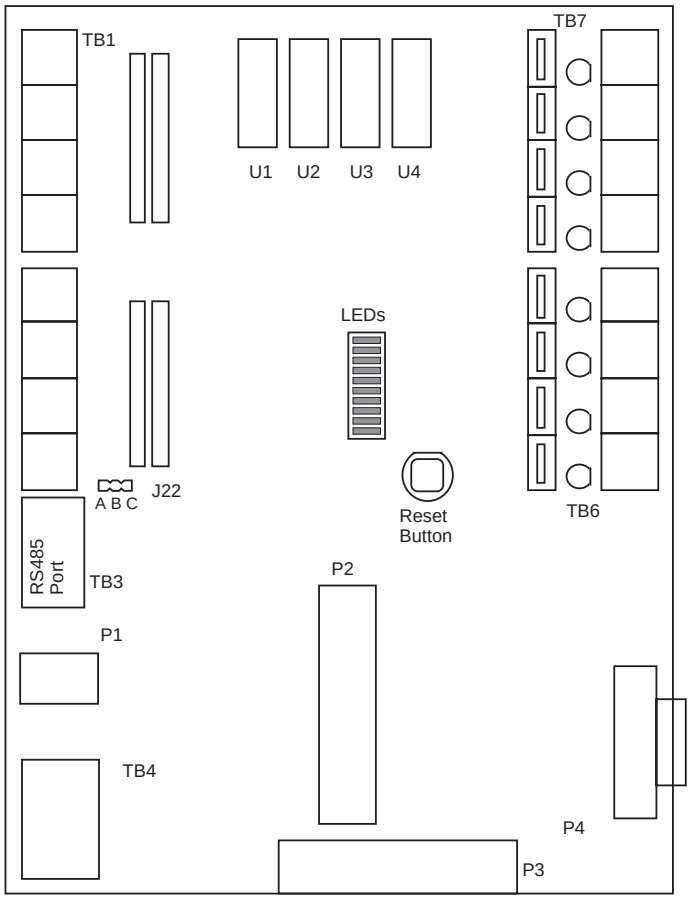

Figure 24. LED Locations

The functions of the LEDs are as shown in Table 5.

Table 5. LED Functions

LED	Label	Function
1	LANTX	Transmitting data to the LAN
2	LANRX	Receiving data from The LAN
3	232TX	Transmitting data to the PC Port
4	232RX	Receiving data from the PC Port
5	HHCTX	Transmitting data to the HHC Port
6	HHCRX	Receiving data from the HHC Port
7	RECON	LAN reconfiguration in progress
8	ALARM	Controller point is in alarm
9	NMI	Low power indicator
10	DISABLE	Outputs are disabled

Several LEDs have more than one illumination pattern, as shown in Table 6.

Table 6. LED Multiple Functions

LED	Label	Description	Indication
1	LANTX	Flashes several times/second	The 7716 is transmitting data to the LAN.
		Blinks for three seconds then stops for two seconds.	The 7716 is not connected to the LAN. *– or –* The 7716 PCU is attempting to search the LAN for some other LAN device.
2	LANRX	Flashing continuously	Data is being received on the LAN port. (Since the LAN port is a half-duplex communication channel, data can be coming from other devices on the LAN or from the 7716 itself.) (There is always LAN communication activity, even if it is only the token passing from unit to unit.)
		Pause	A LAN reconfiguration has begun or is about to begin.
5	HHCTX	Flashes	Data is being received from the CONSOLE port. (Data originates from a HC7410.)
6	HHCRX	Flashes (1 second intervals)	Data is being transmitted from the serial communication processor to the CONSOLE port. (Flashes as time is updated on the hand held console.)
7	RECON	Flashes Constant illumination	Indicates that a LAN reconfiguration is in progress. LAN communication problem.
10	DISABLE	Illuminates momentarily while unit is in operation	Watch-dog-timer has detected no processor activity and has reset the unit.
		Illuminates and stays lit	Microprocessor has failed or is unable to execute programs (possibly due to an improperly-seated memory chip).
		Flashes once	Power has been restored to the unit.

Expansion Ports

In addition to the eight inputs and eight outputs on the base card, the 7716 supports the control of additional relay outputs and the monitoring of additional AI, DI, and PI inputs connected via the expansion port. These inputs and outputs occupy point addresses 0100 through 0107. For additional information, refer to the appropriate expansion module below. Other expansion modules providing additional connections also are available, among these are the RS232 Expansion Module and the RTD Expansion Module.

I/O Expansion Port

All I/O expansion boards, except the RS232 Serial, attach to port P3 at the lower end of the controller PCB (see Figure 25). This optional plug-on expansion module supports the control of an additional sixteen hardware points (eight input and eight output) connected via the expansion port. The expansion port creates a general purpose interface to the 7716's microprocessor bus. This port provides the flexibility to address I/O point quantities and types that are not commonly required or justified for inclusion on the base unit.

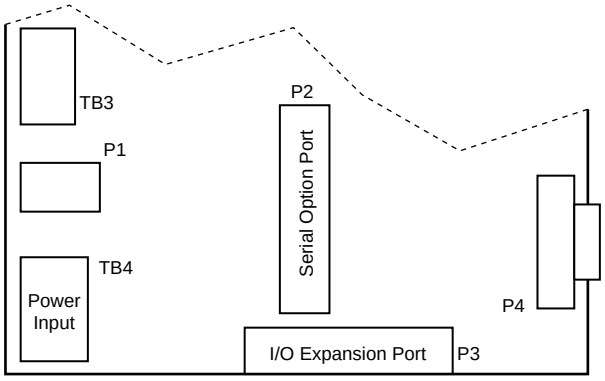

Figure 25. UI/DO Expansion Board Connection

UI/DO Input/Output Expansion Board

The UI/DO Expansion Module (see Figure 26) supports the control of an additional eight input and output points (bringing the total for the base unit and an expansion module to thirty-two) providing a number of I/O options. These points can be used for:

- analog inputs
- discrete inputs
- pulse inputs
- discrete outputs
- PWM outputs

The outputs can be defined in the database as discrete latching contacts, momentary contacts or pulse-width-modulated proportional outputs. The inputs can be defined as analog input, discrete input or pulse input points.

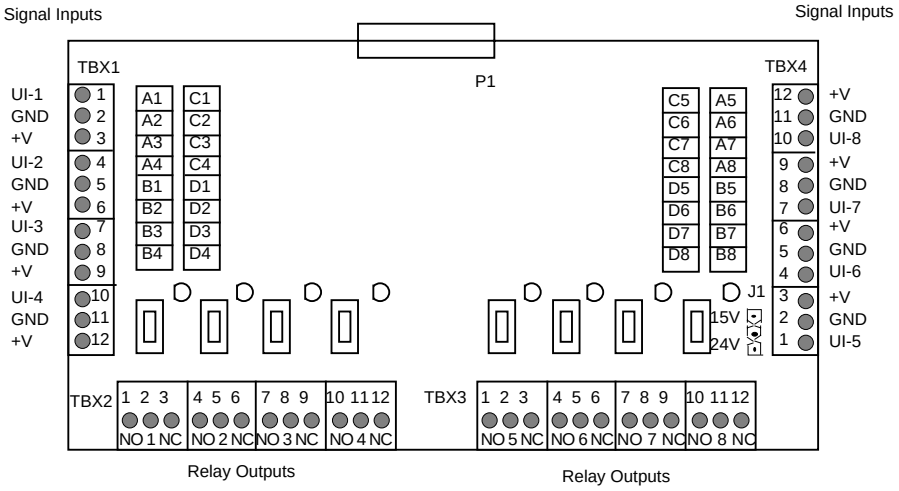

Figure 26. UI/DO Expansion Module

Point Addresses For Inputs

Whether used as analog, discrete, or pulse inputs, the point addresses are 0100 through 0107. Each input point address on the expansion module corresponds with a set of three screw terminals on a terminal block. Addresses 0100 to 0103 are located on TBX1, while addresses 0104 through 0107 are located on TBX4. Each set of three terminals consists of a signal input listed as UI-x (where x is 1 through 8), a ground listed as GND, and the sensor power supply line listed as +V.

The eight inputs on the UI/DO are shipped in a 0–5 volt configuration with no resistors in the resistor packs. The inputs may be configured exactly as the inputs on the base unit are configured (refer to "Resistor Installation" on page -14).

Discrete Outputs Addresses

Whether used as PWM outputs or discrete outputs, the output point addresses are 0100 through 0107. Outputs may be defined as either PWM or discrete. Each output point address on the expansion module corresponds with a set of three screw terminals on a terminal block. Addresses 0100 to 0103 are located on TBX2, while addresses 0104 through 0107 are located on TBX3. Each set of three terminals consists of a signal input listed as NO for Normally Open, a signal input listed as NC for Normally Closed, and the common listed as a number (1 through 8).

UI/AO Expansion Module

The UI/AO Expansion Module (see Figure 27) provides eight universal input and four analog output points. These points can be used for:

- analog inputs
- discrete inputs
- pulse inputs
- analog outputs

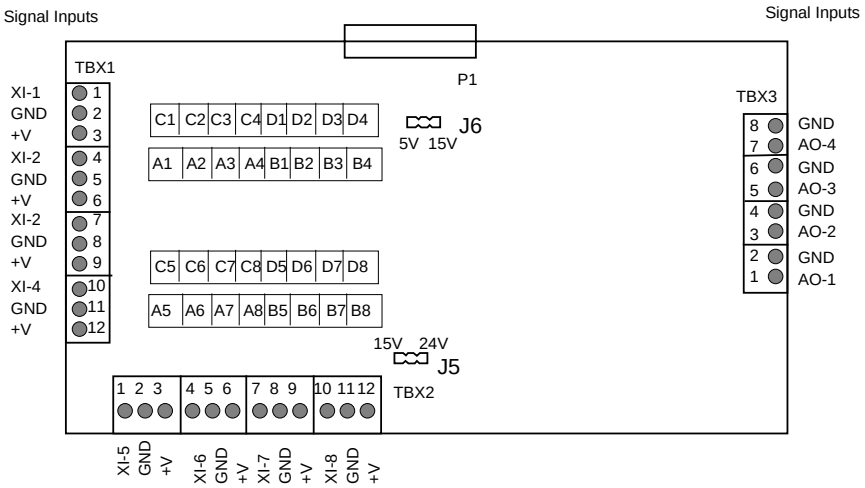

Figure 27. UI/AO Expansion Module

The UI/AO Expansion Module has two variants, one providing 0–10 volt output, and the other providing 4–20 milliampere output. Each variant has a version using optional potentiometers. Variants without the potentiometers are accurate to within 3%, the variants with the potentiometers are factory-calibrated to within 1% accuracy. Both module board variants appear as shown in Figure 27.

Addresses For Inputs

Whether used as analog, discrete, or pulse inputs, the point addresses are 0100 through 0107. Each input point address on the expansion module corresponds with a set of three screw terminals on a terminal block. Addresses 0100 to 0103 are located on TBX1, while addresses 0104 through 0107 are located on TBX2. Each set of three terminals consists of a signal input listed as XI-x (where x is 1 through 8), a ground listed as GND, and the sensor power supply line listed as +V. This board's inputs are shipped as 0–5 V. You may configure the inputs as described for the 7716 PCU baseboard ("Resistor Installation" on page -14).

Analog Output Addresses

Whether used as 0–10 volt or 4–20 milliampere analog outputs, the point addresses are 3100 through 3103. Each output point address on the expansion module corresponds with a set of two screw terminals on a terminal block. Addresses 3100 to 3103 are located on TBX3. Each set of two terminals consists of a signal output listed as AO-x (where x = 1 through 4), and the common listed as GND.

RTD Expansion Module

The RTD Expansion Module allows connection of up to eight platinum RTD elements for temperature measurement over the –40˚ to 212˚ Fahrenheit range. Versions of the RTD Expansion Module support either eight standard 1000-ohm or 100-ohm platinum RTD devices. While the RTD Expansion Module can be wired using 2-wire connection, more accurate temperature measurement is gained using the 3-wire mode. Each of the eight inputs are accompanied by an offset and gain adjustment that is factory-set for the default range and are not user adjustable.

Termination of the field wiring is accomplished through two, twelve conductor, removable terminal blocks that are located along the left and right sides of the expansion board (TBX1 and TBX2). Three terminals are provided for each RTD circuit (see Figure 28).

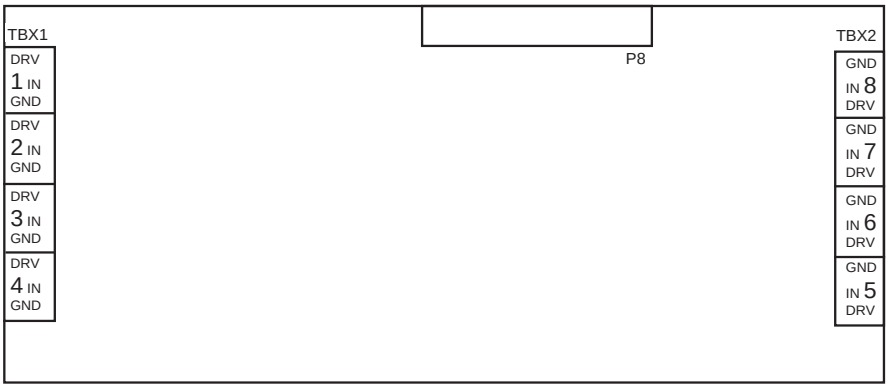

Figure 28. RTD Module

Serial Expansion Module

This interface supports user-selected data rates up to 19,200 BPS. The following devices can be connection to this optional interface:

- External auto-dial/auto-answer (AD/AA) modem — When connected to a Hayes-compatible AD/AA modem, the 7716 will provide the functionality of the 78061 Tap. The following types of modems are supported:
  - Synchronous — Use a synchronous modem when the controller is loaded with an I/NET version 4.x or earlier binary file. The controller must also have I/NET version 4.x boot firmware (EPROM).
  - Asynchronous — Use an asynchronous modem when the controller is loaded with an I/NET 2000 binary file. The controller must also have I/NET 2000 boot firmware (EPROM).

  Use cable number CBL048 for connecting to either of these modems. Refer to TCON145, *I/NET Technical Reference Guide*, or TCON209, *I/NET 2000 Technical Reference Guide*, for more AD/AA information.
- External synchronous dedicated line modem — When connected to an external Hayes-compatible dedicated line modem, the 7716 provides the functionality of a CSI 78035 Tap. Use cable number CBL048 for this connection. Refer to TCON101, *I/NET Tap and Repeater Installation Guide*, for a complete description the 78035 Tap function.
- Another RS232 data communication device.

Refer to TCON101, *7800 Series Taps and Repeater*, for details about CSI Taps.

The optional plug-on RS232 serial expansion module provides a synchronous/asynchronous communication interface at port P2. This port provides a full complement of modem control, and data and clock signals.

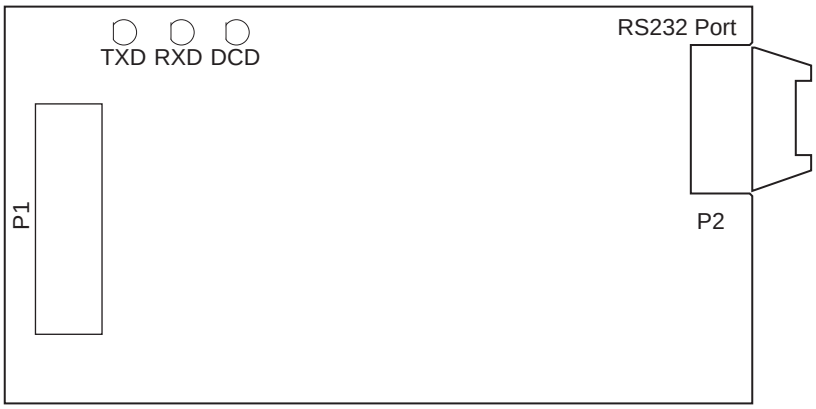

Figure 29. RS232 Serial Interface Board

Tap Emulation and Modem Setup

The 7716 controller can be configured to emulate several types of CSI Taps, as follows:

- 7801 Host Tap — Using this emulated Tap, you can connect the following devices directly to the 7716 controller at port P4:
  - Host Workstation — This connection supports the "Direct-connect" function of the 7801 host Tap.
  - Asynchronous Hayes-compatible Modem — When the modem is configured to auto-answer incoming calls, this connection supports the "Integrated Dial" function of the 7801 host Tap. This configuration allows you to use voice-grade phone lines to communicate with the controller LAN from a remote PC.
- 78035 Site (LAN) Tap — This emulated Tap requires the use of an optional RS232 expansion module. Using this Tap function, you can connect a synchronous dedicated-line (i.e., leased-line) modem to port P2 of the RS232 expansion module.
- 78061 Dial Site (LAN) Tap — This emulated Tap requires the use of an optional RS232 expansion module. Using this Tap function, you can connect a Hayes-compatible modem to port P2 of the RS232 expansion module. You may then configure the modem for auto-dial/auto-answer (AD/AA) operation (refer to "Modem Switch Settings" on page 34).

Note: *When using the emulated 78061 Tap function, the controller's binary load (i.e., *.BIN file) determines whether a synchronous or an asynchronous modem will be required for AD/AA communication. For an I/NET 2000 binary load, the modem must be capable of asynchronous communication. For an I/NET revision 4.x or earlier binary load, the modem must be capable of synchronous communication. Refer to the communication chapter in TCON145, "I/NET Technical Reference Guide," or TCON209, "I/NET 2000 Technical Reference Guide," for more information about AD/AA communication.*

Ensure that all AD/AA Taps within your I/NET system are configured to use the same communication protocol — either synchronous, or asynchronous. Mixing AD/AA protocols will cause communication errors.

78061 Emulation and Beeper Calls

Beeper calls are used to notify a user of a specific condition occurring in the I/NET system. This condition is user definable using message masking and priorities. The beeper is only a notification tool. It contains no originating code or phone number. It issues either a tone or vibrates the beeper. To specify a beeper call, select Beeper in the Type field of the 7806 Configuration editor. If a beeper service is used, enter the beeper service phone number. If a human response is expected, enter an @ symbol at the end of the beeper number. This will allow the 78061 Tap emulation to retry on busy and no-answer conditions.

The @ symbol will cause the modem to listen for a 5-second period of silence after the first ring is detected. The length of time that the modem will listen for this period of silence is established by the Timeout field in the editor. If a period of silence is detected, the call will be considered complete.

Note: *Some experimentation with the timeout period that is set in the Tap editor may be required. This timeout period should be set long enough to cause the modem to "hang on the line" until the 5-second period of silence can be detected.*

Since this beeper function is used internationally to cause dial out to numbers that will have a human response, it is necessary to accommodate differences in the manner in which beeper systems and humans respond. When using an external modem (78061 Tap emulation) you should initialize your Hayes-compatible modem with the X4 command (factory default), which enables your modem to return the busy response code if it is expected that a person will answer (or not answer) the telephone. This will provide a rapid response to a busy error.

Note: *It is imperative that any modem used for beeper interfacing operate as described above.*

The 78061 emulation will alter the modem initialization timing sequence to always initialize at a 2400 baud data rate.

Note: *The 7716 PCU will send a setup string to the modem to place it in the auto-answer mode. This auto-answer function will be set to answer on the first ring.*

78061 Tap Emulation and Pager Operation

Select pager operation in the I/NET software by selecting Beeper from the Type field. Pager operation is used to notify a user of a specific condition occurring in the I/NET system. This condition is user-definable using message masking and priorities. The pager is designed to receive a string of characters that are displayed on the recipient's pager. This string could represent a phone number or a recognizable warning code. You may call a pager using the 78061 Tap emulation. The current version of I/NET adds several additional phone number characters for use with dial strings. Table 7 shows the additional characters and their definitions.

Table 7. Pager Character Definition

Pager Character	Definition
@	Waits for five seconds, replaces the need for numerous commas.
;	Causes an immediate hang up, and should be used at the end of every digital pager number dialed. (Not for use with a beeper.)
!	Issues a Hook flash, forcing the phone to go on-hook for 0.5 seconds.
W	Wait for a dial tone.

A pager differs from a beeper in that the pager sends a string of characters after a 5-second period of silence. Also, beepers never use the semi-colon in their call string, while digital pagers always require the semi-colon at the end of their call string. It is important that you be familiar with your pager service and phone system so that you know of any specific characters that may be required to place a successful call. For example, if you were to enter a phone number for SWB MobileComm Pagers in a 78061 Tap emulation, using an ITT System 3100 PBX, you would use the following format:

T9W8172731511#@123456;

The "T" at the beginning of the character string initiates tone dialing, the 9 obtains an outside line. The "W" causes the Tap to wait for the modem to receive a dial tone before dialing the pager service phone number. At the end of the phone number is a # sign that causes this PBX to perform speed dialing, eliminating any unwanted delays.

The @ character causes the 78061 Tap emulation to wait five seconds and then sends the code that will display on the recipient's pager. The semi-colon causes the Tap to signal the modem to immediately go on-hook, ending the call.

If your telephone system has no speed dial function, but has a period of silence exceeding five seconds before the connection is made, add additional @ characters or commas to prevent the Tap prematurely sending the pager code.

If the number being dialed is really a pager system (particularly a digital pager system), the modem should be initialized with an X2 command. This will cause the modem to ignore at least some of the tones presented by the digital pager system (that may be interpreted as busy) when the call is successful.

Note: *Some experimentation may be required to find the proper combination of characters to make the pager call successful.*

Modem Switch Settings

The 7801 Integrated Dial and 78061 AD/AA emulated Tap functions require the use of external modems. You must configure these modems for proper communication. For modems without hardware switch settings (i.e., with software-controlled switch settings only), a terminal emulator, such as Procom, or the communication software received with your modem, must be used to issue command strings to the modem for proper initialization. The modem setup requirements are described in the following paragraphs.

Auto-dial/Auto-answer

Note: *When using the emulated 78061 Tap function, the controller's binary load (i.e., *.BIN file) determines whether a synchronous or an asynchronous modem will be required for AD/AA communication. For an I/NET 2000 binary load, the modem must be capable of asynchronous communication. For an I/NET revision 4.x or earlier binary load, the modem must be capable of synchronous communication. Refer to the communication chapter in TCON145, "I/NET Technical Reference Guide," or TCON209, "I/NET 2000 Technical Reference Guide," for more information about AD/AA communication.*

The optional RS232 expansion module (port P2) can be used as an interface for an external Hayes-compatible auto-dial/auto-answer (AD/AA) modem. This configuration is supported when the 7716 is set to emulate a 78061 site (LAN) Tap. Issue the following settings to your Hayes-compatible modem from a terminal emulator.

1. AT &F
2. AT E0 M1 Q0 V0 &C1 &D2 &M1
3. AT S0=1 S7=60
4. AT &W0
5. Cycle power on the modem to store the setup commands of the user's profile to the modem's NOVRAM.

Integrated Dial

The asynchronous serial communication port (P4) on the 7716 can be used as an interface for an external Hayes-compatible auto-answer (i.e., Integrated Dial) modem. This configuration is supported when the 7716 is set to emulate a 7801 host Tap. Use the following setup instructions to configure the modem at the host workstation and the modem at the 7716 controller.

Call Initiating End

The following is for an Integrated Dial (one-way) setup from the host PC. Use the following DIP switch settings, or software-controlled switch settings, to initialize your modem.

Hayes 1200 baud modem, or compatible, connected to the PC at the call initiating end must have switches 1, 6, 7, 9, and 10 up.

Hayes 2400 baud Smartmodem™, or compatible, issue the following settings from a terminal emulator.

1. AT &F
2. AT E0 V0 X1 &C1 &D2 S7=60
3. AT &W0
4. Cycle power on the modem to store the setup commands of the user's profile to the modem's NOVRAM.

Hayes OPTIMA™ series Smartmodem, or compatible, issue the following settings from a terminal emulator.

1. AT &F
2. AT E0 V0 X0 &C1 &D2 S7=60 (S37=0 for OPTIMA 9600 **only**)
3. AT N0 &K0 &Q0
4. AT &W0
5. Cycle power on the modem to store the setup commands of the user's profile to the modem's NOVRAM.

The cable required to connect the modem to the COM port of the PC is a CSI model number CBL0008.

Call Receiving End

The following is for an Integrated Dial (one-way) setup from the controller LAN. Use the following DIP switch settings or software-controlled switch settings to initialize your modem.

Hayes 1200 baud modem, or compatible, connected to the 78010 Tap at the LAN call receiving end must have switches 3, 5, 7, 8, 9 and 10 up.

Hayes 2400 baud Smartmodem, or compatible, issue the following settings from a terminal emulator.

1. AT &F
2. AT E0 Q1 &C1 &D0 S0=1 S7=60

3. AT &W0
4. Cycle power on the modem to store the setup commands of the user's profile to the modem's NOVRAM.

Hayes OPTIMA series Smartmodem, or compatible, issue the following settings from a terminal emulator.

1. AT &F
2. AT E0 Q1 &C1 &D0 S0=1 S7=60
3. AT N1 &K0 &Q0
4. AT &W0
5. Cycle power on the modem to store the setup commands of the user's profile to the modem's NOVRAM.

Field Hardware Checkout and Addressing

Field hardware checkout is essential before any piece of mechanical equipment can begin to be controlled by the 7716. This checkout ensures that the field devices are working correctly, and that they are correctly wired to the 7716.

After successful checkout of the field hardware, the unit is ready to start controlling the mechanical equipment and final terminations to actual field devices can be completed.

Use a HC7410 to perform all hardware checkout and addressing of the 7716. Connections between the 7716 and the HHC are made using an RJ11 connection (P1) on the 7716 PCB. Set the address of the 7716 before connecting it to the LAN.

Connecting the HHC

1. Apply power to the 7716.
2. Plug the HC7410 into 7716 at P1 on the 7716 PCB.
3. Press the [**Clear**] key on the HC7410. The display will show the PCU time in 24-hour format, updating every second if the unit is operating properly.

Note: *When the 7716 is powered up, it attempts to reconfigure the controller LAN and become part of it. This is indicated by the intermittent flashing of LED 7 (RECON).*

Cold Starting the 7716 PCU

There are occasions when you may wish to cold start (clear the database) of a PCU currently operating on the LAN. Using the HC7410, complete the following procedure.

1. Plug the silver cord (P/N: 602135-0003) into the RJ11 port labeled P1 (CONSOLE).
2. Press [**DCU ADDR**]. The current PCU address displays in the two right-most digits of the HHC display.
3. Enter a different address using the numeric keys. If possible choose an address not already used by another DCU on the LAN. The address displays as it is entered.

4. Press [**Enter**]. The PCU RAM is cleared with all database information and the new PCU address is stored.
5. Reenter the desired (original) address following Steps 2 through 4.
6. Set the 7716 data rate using the steps in "Setting the Controller LAN Baud Rate" on page -21.

Check Signal Voltages

You will need a digital voltage meter and a HC7410 to complete the following checkout procedure.

Check signal voltages for each analog input point using the meter. The GND terminal of each input point is common. Signal voltage should be present at input terminals 1 through 8.

Check Analog Inputs

Using the HC7410, repeat the following key entries for each of the analog input devices connected to the 7716.

HHC Key	HHC Display	Comments
DSPLY	000000	
AI	000000	Select analog input type
PPBB	0000 to 0107	The point address being checked
ENTER	000000 to 000FFF	000000 in the display indicates a zero scale input 000FFF in the display indicates a full scale input
CLEAR	TIME	on PCU

Ensure that the correct field sensor is being monitored by the correct analog input address.

Checkout Discrete Inputs

Using the HC7410, repeat the following key entries for each of the discrete or pulsed input devices connected to the PCU.

The PP portion of the address is the point address on the 7716. The BB portion of the address will vary according to the input point being tested.

HHC Key	HHC Display	Comments
DSPLY	000000	
DI	00000	Select discrete input type
PPBB	0000 to 0107	The point address being checked
ENTER	000000	000000 in the display indicates an open set of contacts
	or 000001	000001 in the display indicates a closed set of contacts
CLEAR	TIME	on PCU

Ensure that the correct field sensor is being monitored by the correct discrete input address.

Checkout Discrete Outputs

Using the HC7410, repeat the following key entries for each of the discrete output devices connected to the PCU.

The SS portion of the address is the address of the Model 7716. The PP portion of the address is the input or output address. The BB portion of the address will vary according to the output point being tested.

HHC Key	Display	Comments
CTRL	000000	
DO	000000	Select discrete output type
PPBB	0000 to 0107	The point address being checked
ENTER	000000	ON or OFF lamp on the hand held console illuminates indicating status of the respective output.
OFF	TIME	Relay is energized on PCU
CLEAR	TIME	
CTRL	000000	
DO	000000	
PPBB	0000 to 0107	The point address is being checked
ENTER	000000	ON or OFF lamp on the hand held console illuminates indicating status of the respective output. OFF lamp should be illuminated due to the previous sequence.
ON	TIME	Relay is deenergized on PCU
CLEAR	TIME	

Ensure that the correct field device is being controlled by the correct discrete output address.

7716 Point Address Summary

All baseboard addresses begin with 00 (PP). All expansion board addresses begin with 01 or, for AO points, 31 (PP). Point addresses labeled below as internal will be used only as internal points (they do not have an external hardware point associated). Points labeled below as external can be defined as external (hardware points) or internal.

Inputs

There are a total of 320 input points available through the 7716.

Location	Point Type	Number of Points	Point Address
Base Hardware	External AI/DI/PI	8	0000–0007
Expansion Unit	External AI/DI/PI	8	0100–0107
Base HOA Switched	Internal	288	Bit offset 0–7 on pts 02–15. Bit offset 0–9 on pts 16–31.
Input points may be defined as AI, DI, or PI, but only one type can be defined for a specific point.			
Base HOA	External DI	16	Bit offset 8 and 9 on pts 00–07
Expansion HOA	External DI	16	Bit offset 8 and 9 on pts 08–15

Outputs

There are a total of 320 output points available through the 7716.

Location	Point Type	Number of Points	Point Address
Base Hardware	External DO/PWM	8	0000–0007
Expansion Board	External DO/PWM	8	0100–0107
	External AO	4	3100–3103
	Internal	304	Bit Offset 0–9 on pts 02 to 30 Bit offset 4–9 on pt 31
			Bit offset 8 and 9 on pts 00 and 01
Output points may be defined as DO or PWM, but not as both.			

Resistor Configurations

Table 8. Resistor Configuration Summary

Point Type	Resistor Type	Configuration
0–20 mA	249 ohm, 1/8 W, 0.1%	A
2-wire Linitemp	10K ohm, 1/8 W, 0.1%	A
0–10 V	100K ohm, 1/8 W, 1%	C
DI/PI	1K ohm, 1/8 W, 5%	B
Supervised points	1K ohm, 1/4 W, 1%	On cable run

HOA Switch Status

HOA switches are to the left of the output relays on the 7716 base unit, and above the output relays on the UI/DO expansion board.

Table 9. HOA Switch Functions

Switch Position	Operation
CENTER	Output is under Automatic control
DOWN	Output energized (ON) Bit 08 = 1
UP	Output deenergized (OFF) Bit 09 = 1

Note: Software provides automatic control. Other positions are for maintenance.

On the base unit, DI points 0008 and 0009 through 0708 and 0709 are the feedback addresses for the output addresses 0000 through 0007.

On the expansion unit, DI points 0808 and 0809 through 1508 and 1509 are the feedback addresses for the output addresses 0100 through 0107.

If you place a switch in the On (Down) or Off (Up) position, the software indicates that someone has put that point into manual override. The corresponding feedback points are shown below with the inputs from the manual switches.

Location	DI Input Pt	UP/DOWN Position	Feedback for Point
Base unit	0008	DOWN	DO 0000
	0009	UP	DO 0000
	0108	DOWN	DO 0001
	0109	UP	DO 0001
	0208	DOWN	DO 0002
	0209	UP	DO 0002
	0308	DOWN	DO 0003
	0309	UP	DO 0003
	0408	DOWN	DO 0004
	0409	UP	DO 0004
	0508	DOWN	DO 0005
	0509	UP	DO 0005
	0608	DOWN	DO 0006
	0609	UP	DO 0006
	0708	DOWN	DO 0007
	0709	UP	DO 0007
Expansion board	0808	DOWN	DO 0100
	0809	UP	DO 0100
	0908	DOWN	DO 0101
	0909	UP	DO 0101
	1008	DOWN	DO 0102
	1009	UP	DO 0102
	1108	DOWN	DO 0103
	1109	UP	DO 0103
	1208	DOWN	DO 0104
	1209	UP	DO 0104
	1308	DOWN	DO 0105
	1309	UP	DO 0105
	1408	DOWN	DO 0106
	1409	UP	DO 0106
	1508	DOWN	DO 0107
	1509	UP	DO 0107

Troubleshooting

Symptom	Possible Cause(s)
No LED indicators are flashing (unit is dead)	Power transformer not properly connected to AC power
	AC power input connector not seated
	Power cord damaged
	On-board power supply damaged
	AC power transformer damaged
LAN reconfigures continuously	PCU has same station address as another device on the LAN
	Connections not correct at the LAN port. Look for wires touching each other.
	Short has been created in communication cable. Use Ohm meter to determine if short exists.
	Single LAN segment has exceeded 5,000 feet (1,500 m) distance limitation. Install a CSI Model 7808 Repeater.
	Single LAN has more than 32 CSI LAN devices on it. Install a CSI Model 7808 Repeater.
	The main trunk of the LAN has exceeded the 25,000 feet (7,500 m) limitation. Use two segments separated by a repeater (7808 Repeater Tap).
	There are more than four Model 7808 Repeaters between any two CSI LAN devices
	Bias has not been set on the Model 7808 Repeater for the LAN segment
Hand-held console will not work when connected to Tap	Connection not correct at Console port
	Hand-held console's RJ11 connector is damaged
Analog input readings are high/low	Incorrect resistor has been installed for the input
	Analog power supply (+15 VDC) has been damaged
Memory lost after power failure	Unit has not been powered up long enough to charge battery

Pinout Chart

7716 Baseboard Unit

Location: _____ Station Address:_____

Inputs	Terminal Block	Point Type/ Address	Point Description
1	TB1-1	AI/DI/PI 0000	
2	TB1-4	AI/DI/PI 0001	
3	TB1-7	AI/DI/PI 0002	
4	TB1-10	AI/DI/PI 0003	
5	TB2-1	AI/DI/PI 0004	
6	TB2-4	AI/DI/PI 0005	
7	TB2-7	AI/DI/PI 0006	
8	TB2-10	AI/DI/PI 0007	

Outputs	Terminal Block	Point Type/ Address	Point Description
1	TB6-1, 2, 3	DO/PWM 0000	
2	TB6-4, 5, 6	DO/PWM 0001	
3	TB6-7, 8, 9	DO/PWM 0002	
4	TB6-10, 11, 12	DO/PWM 0003	
5	TB7-1, 2, 3	DO/PWM 0004	
6	TB7-4, 5, 6	DO/PWM 0005	
7	TB7-7, 8, 9	DO/PWM 0006	
8	TB7-10, 11, 12	DO/PWM 0007	

Internal RS232

Output Connection	Emulation/Modem	Description
External PC	7801 Tap	
Asynchronous	Hayes-compatible Modem	

RS232 Expansion Module

Location: _____
Station Address:_____

Output Connection	Emulation/Modem	Description
Synchronous or Asynchronous Modem	78061 Tap	
Synchronous modem	78035 Tap	

UI/DO I/O Expansion Module

Location: _____
Station Address:_____

Inputs	Terminal Block	Point Type/Address	Description
UI-1	TBX1-1	AI/DI/PI 0100	
UI-2	TBX1-4	AI/DI/PI 0101	
UI-3	TBX1-7	AI/DI/PI 0102	
UI-4	TBX1-10	AI/DI/PI 0103	
UI-5	TBX4-1	AI/DI/PI 0104	
UI-6	TBX4-4	AI/DI/PI 0105	
UI-7	TBX4-7	AI/DI/PI 0106	
UI-8	TBX4-10	AI/DI/PI 0107	

Outputs	Terminal Block	Point Type/Address	Description
1	TBX2-1, 2, 3	DO/PWM 0100	
2	TBX2-4, 5, 6	DO/PWM 0101	
3	TBX2-7, 8, 9	DO/PWM 0102	
4	TBX2-10, 11, 12	DO/PWM 0103	
5	TBX3-1, 2, 3	DO/PWM 0104	
6	TBX3-4, 5, 6	DO/PWM 0105	
7	TBX3-7, 8, 9	DO/PWM 0106	
8	TBX3-10, 11, 12	DO/PWM 0107	

UI/AO I/O Expansion Module

Location: _____
Station Address:_____

Inputs	Terminal Block	Point	Description
XI-1	TBX1-1	AI/DI/PI 0100	
XI-2	TBX1-4	AI/DI/PI 0101	
XI-3	TBX1-7	AI/DI/PI 0102	
XI-4	TBX1-10	AI/DI/PI 0103	
XI-5	TBX2-1	AI/DI/PI 0104	
XI-6	TBX2-4	AI/DI/PI 0105	
XI-7	TBX2-7	AI/DI/PI 0106	
XI-8	TBX2-10	AI/DI/PI 0107	

Outputs	Terminal Block	Point	Description
AO-1	TBX3-1, 2	AO 3100	
AO-2	TBX3-3, 4	AO 3101	
AO-3	TBX3-5, 6	AO 3102	
AO-4	TBX3-7, 8	AO 3103	

RTD I/O Expansion Module

Location: _____
Station Address:_____

Inputs	Terminal Block	Point	Description
1	TBX1-1, 2, 3	AI 0100	
2	TBX1-4, 5, 6	AI 0101	
3	TBX1-7, 8, 9	AI 0102	
4	TBX1-10, 11, 12	AI 0103	
5	TBX2-1, 2, 3	AI 0104	
6	TBX2-4, 5, 6	AI 0105	
7	TBX2-7, 8, 9	AI 0106	
8	TBX2-10, 11, 12	AI 0107	

Specifications

Dimensions

Baseplate: 13.75" W × 9.60" L (34.9 × 24.4 cm)

Controller PCB: 9.00" L × 8.50" W × 1.80" H (22.9 × 21.5 × 4.5 cm)

All I/O Expansion Boards: 8.50" L × 3.20" W (21.5 × 8.1 cm)

RS232 Serial Expansion Board: 3.50" L × 3.20" W (8.9 × 8.1 cm)

Operating Environment

Temperature: 32°F to 122°F (0°C to 50°C)

Humidity: 10 to 90%, non-condensing

Power: 24 VAC ±10%, 50/60 HZ (40 VA max)

Analog transducer power supply:
15 VDC or 24 VDC (160 mA max. load)

Battery backup: 30 day

Note: *This product contains a Nickel-Cadmium (NiCad) rechargeable battery. This battery should not be crushed or incinerated when disposing of this product.*

The backup battery must be fully charged in order to provide the full span of backup power. Due to normal discharge during product storage and shipment, the battery may not be fully charged immediately following installation and power-up. You must allow the controller to operate continuously for a minimum of seven days (168 hours) before depending on battery backup.

Processor: Zilog Z181

Universal Inputs

Quantity: 8 (on base)

Analog inputs

Range: 0–5 VDC or 0–20 milliampere

Input over range: 15 V max (with volts input)
0.25 watt max (with current input)

Accuracy: 0.1% (0–5 V input)
0.5% (0–20 mA input),
2% (0–10 V input)

Temperature Coefficient: 100PPM/°C

Discrete Inputs

Contact excitation: 5 V @ 5 mA

Contact loop resistance: 100 ohms maximum

Input duration: 120 m/sec. minimum

Pulse Input Rate: 4 Hz Maximum

Outputs

Quantity: 8 (on base)

Type: Form-C (SPDT) Relay Contacts

Rating: 24 VAC/VDC @ 0.5 A

Operating Modes: Latched, Momentary, & PWM
Proportional

Telephone Numbers

The 7716 PCU can store the following telephone number information:

- Maximum of 8 groups
- Maximum of 8 telephone numbers
- Maximum of 31 characters per telephone number

Due to PCU memory limitations, all maximum values cannot be achieved simultaneously.

LAN Port

Baud Rate 9600 baud, variant 19,200 BPS

Interface: RS485

Protocol: SDLC (token passing bus)

Universal Enclosures

Model ENCL1813
U.L. 916 listed

Index

L

M

O

P

R

S

T

U

V

Z

Warranty

Repair or Replacement

If this unit fails to operate because of a defect in materials or workmanship within two (2) years of the date you purchased it, it will either be repaired or replaced by Control Systems International, Inc. (CSI) at no charge to you. Before contacting CSI, it is recommended that you first contact the dealer from whom you purchased this equipment to determine whether they will have it repaired or replaced. If the dealer will not, please contact CSI to arrange to have this equipment repaired or replaced.

CSI EXPRESSLY RESERVES THE RIGHT TO REPAIR OR REPLACE THIS EQUIPMENT WITH NEW OR REFURBISHED PARTS OR EQUIPMENT.

Exclusions and Limitations

Your warranty does not cover:

- Damage by negligence, misuse, or accident
- Compatibility with the equipment of any other manufacturer
- Modifications to the equipment to make it compatible with the equipment of any other manufacturer
- Damage to the equipment resulting from improper installation or operation.

Legal Rights and Limits

All applicable implied warranties, including the implied warranty of merchantability and of fitness for a particular purpose given to you by law are hereby limited in durability to the duration of this warranty. Under no circumstances will CSI be liable for any incidental or consequential damages.

Some states in the U.S.A. do not allow limitations on how long implied warranties last, or exclusions or limitations of incidental or consequential damages, so exclusions or limitations mentioned may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Purchaser's Responsibility

In order to obtain service under this warranty, you must deliver the equipment to the place of purchase or to CSI and provide proof of the original purchase date along with the returned equipment. Failure to provide adequate proof of the original purchase date could result in denial of warranty service.

Out of Warranty Service

Direct requests for information on out-of-warranty service to Product Service Manager at the address below.

CSI Control Systems® International

P.O. Box 59469, Dallas, Tx 75229
Phone: (972) 323-1111
FAX Phone: (972) 242-0026

CSI Europe
Unit B3, Armstrong Mall
Southwood, Farnborough
Hampshire GU14 ONR, United Kingdom
Phone: 44 1252 370900
FAX Phone: 44 1252 372470

CSI Pacific
36 Hasler Rd.
Osborne Park, Western Australia 6017
Phone: 61-9-244 2799
FAX Phone: 61-9-244 4335

You may obtain copies of this document by ordering document number TCON096.

TCON096 – 01/99