INSTALLATION AND OPERATION INSTRUCTIONS

CEnDe MULTIPLEX COMMUNICATIONS SYSTEM DCU

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CEnDe Multiplex Communications System
DCU

April, 2001

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PROPRIETARY INFORMATION

THE TECHNIQUES AND METHODS DISCUSSED IN THIS DOCUMENT ARE CONSIDERED TO BE PROPRIETARY TO PPi AND MUST NOT BE DISCLOSED IN WHOLE OR IN PART FOR ANY PURPOSE OTHER THAN FOR USE IN INSTALLATION, OPERATING, AND REPAIRING THE SYSTEM.

HOW TO USE THIS MANUAL

The Data Collection Unit (DCU) is a microcomputer based "smart" alarm control unit designed to interface Perimeter Products fence protection sensor systems with computer based or other control systems by other manufacturers. The DCU will primarily be used where Perimeter Products multiplex based sensors such as the FPS-2-2M or the GL-M must be integrated into a large central control and reporting system by another manufacturer.

Before attempting any system design or installation requiring the installation of a DCU, your should read this manual completely. Because other Perimeter Products components will normally be installed in conjunction with the DCU, the manuals of all the other equipment should be studied at the same time. As you read this manual you will encounter references to the manuals of the other Perimeter Products equipment. Those manuals should be available for reference.

The Initial Startup Section of this manual contains step by step instructions that should be followed directly. Read the instructions completely before attempting the procedures and then use the manual as a guide to complete the procedures.

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INSTALLATION AND OPERATION INSTRUCTIONS

DATA COLLECTION UNIT (DCU)

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INSTALLATION AND OPERATION INSTRUCTIONS

DATA COLLECTION UNIT (DCU)

1.0 GENERAL DESCRIPTION

1.1 Purpose

1.1.1 The Data Collection Unit(DCU) is specifically designed to interface Perimeter Products field mounted fence protection sensor systems with central command and control systems by other manufacturers. Many integrated security and communications systems utilize a large central computer to monitor and manage the total electronic security of a facility. In these cases, the PPI fence protection sensors must be cost effectively interfaced to the central computer system. The DCU provides a "smart" microcomputer based interface for connecting field installed PPI sensor systems using the proven CEnDe multiplex communications system.

1.1.2 The CEnDe communications system allows connection to remote devices up to 20,000 feet from the DCU.

1.1.3 The DCU outputs are programmable relay contacts that can provide either an open or closed contact on alarm or tamper. All alarm outputs are purposely separated to increase interface flexibility.

1.2 Features

1.2.1 The DCU is a microprocessor-based control unit using a state-of-the-art microprocessor and software instruction set.

1.2.2 Communications from the field equipment to the DCU is via the proven CEnDe multiplex system. Field installed processors can be installed up to 20,000 feet from the DCU.

1.2.3 Alarm reporting occurs in one second or less.

1.2.4 Capable of accepting up to 20 zones of PPI fence protection systems and provide either an open or closed contact alarm interface.

1.2.5 Provides local alarm outputs for common alarm, tamper or communications failure. Local alarm interface is via relay contacts.

1.2.6 Capable of accepting control inputs from other equipment at the DCU and activating corresponding signals at field mounted processors.

1.3 Specifications

Size	18 1/2"W X 14 1/4"H X 4 1/8"D (47cm X 36cm X 10.5 cm)
Weight	Approximately 12 lbs (26 kg.)
Shipping Weight	Approximately 16 lbs. (35 kg.)
Power Requirements	24 VAC provided by a furnished transformer
Alarm Inputs	From field units via transponder
Standby power provision	24 VDC, 20 AH battery (optional) Built-in charger
Operating Temperature	32 F. to 120 F. (0 C. to 50 C.)
Multiplex Bus Mode	Two (2) wire duplex
Multiplex Bus Maximum Length	20,000 ft. (6.1 km.)
Communication Bus Configuration	Class A or B
Relay Outputs	One each per zone; alarm and tamper NO or NC, jumper selectable rating; 28 VDC, 250 ma
Command Input Capability	48 inputs available at the DCU for commanding functions at the remote processors Dry circuit interface, screw terminals
Local Outputs	Independent relay contacts for common alarm, tamper and communications failure. NO/NC jumper selectable.

2.0 THEORY OF OPERATION

2.1 Concept

2.1.1 The DCU was designed to provide interface of the Perimeter Products Security Systems to control systems of other manufacturers. The DCU utilizes the proven CEnDe multiplex loop communications system to gather alarm and other information from field installed transponders. The transponders are typically the Perimeter Products fence protection systems that also contain CEnDe communications transponder interfaces.

2.2 System Operation

2.2.1 The DCU is a microprocessor based device designed specifically to be used in conjunction with the Perimeter Products Security Products. The DCU contains an instruction set that allows interface with the CEnDe multiplex communications network and provide programmable relay contact outputs that can be used to provide the alarm information to systems by other manufacturers.

2.2.2 The DCU contains a microprocessor, Random-Access-Memory (RAM) for in-process information, and a Read-Only-Memory (ROM) containing the operating instructions for the processor. The operation of the DCU is primarily for interface of PPI fence protection sensors using the CEnDe multiplex communications system.

2.2.3 A block diagram of the DCU is contained in Figure 2-1. The layout of a DCU unit is shown in Figure 2-2.

2.2.4 Inputs are received by the Remote Controller circuit board through the modem that interfaces the CEnDe multiplex communications loop to the DCU microprocessor and software system. The DCU has the capability to communicate with up to 10 remote processors or a total of 20 alarm zone inputs.

2.2.5 The remote controller board provides alarm and tamper outputs to the relay interface circuit board over the internal bus. The internal bus signals are decoded by the relay decoder mounted on the door of the DCU cabinet. The decoded outputs are wired to the relay interface board containing 48 relays. Five relay outputs are provided for the first 8 transponder inputs and four relay outputs for the last two transponders. Each relay output can be programmed as either a normally open or normally closed contact.

2.2.6 The function of each relay is controlled by the type of transponder that is connected to the DCU. The DCU is typically connected to transponders contained in the FPS-2-2M, GL-M, Stand-alone Transponder and the PAS-120 PARC units. Table 2-1 shows the output function of each relay based on the type of transponder connected.

2.2.7 The DCU also provides local relay outputs for common alarm, common tamper, and communications failure. These programmable relays, located on the Remote Controller circuit card operate whenever one or more alarm or tamper signals, or a communications failure is present.

2.2.8 The DCU is capable of controlling selected functions at each of the field processors. Inputs to the DCU in the form of dry circuit contacts are connected to the input terminals contained in the DCU enclosure. See Figure 2-2.

2.2.9 The function of each input is controlled by the type of transponder that is connected to the DCU. The DCU is typically connected to transponders contained in the FPS-2-2M, GL-M, Stand-alone Transponder and the PAS-120 PARC units. Table 2-2 shows the function that will be remotely controlled based on the type of transponder connected.

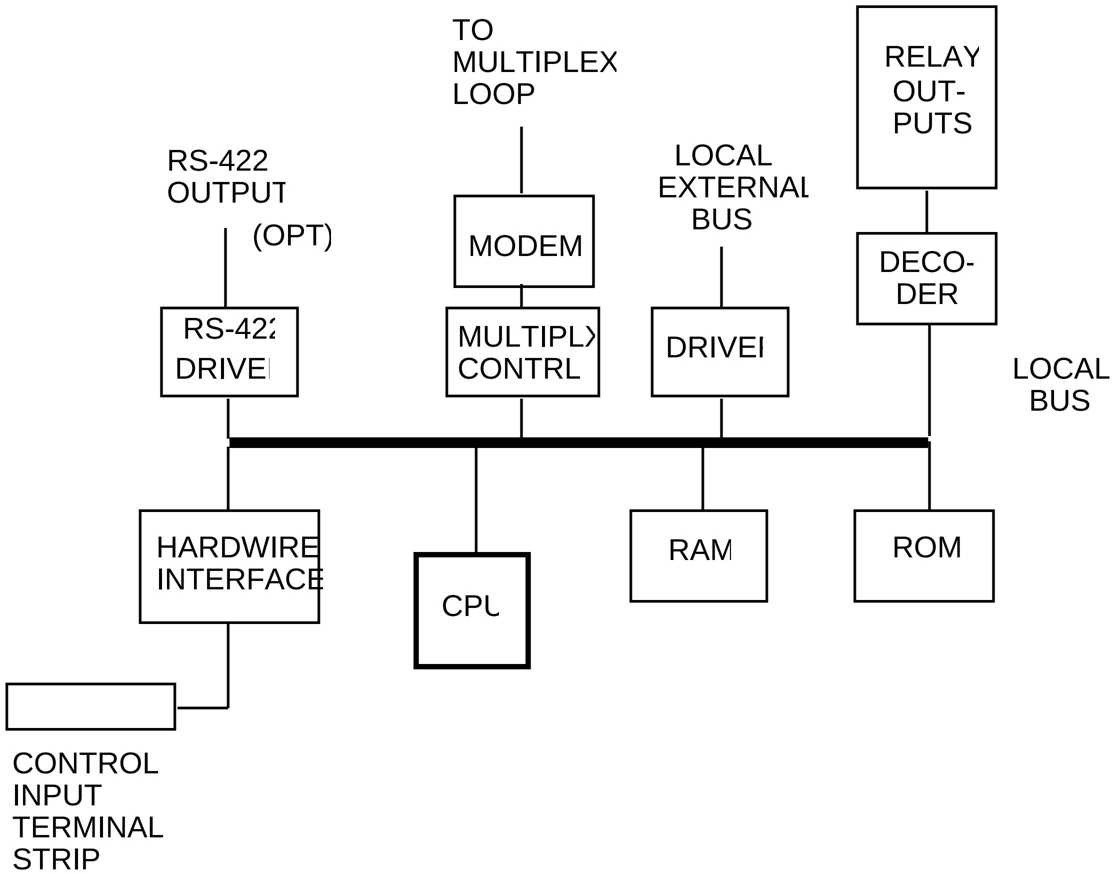


Figure 2-1
Block Diagram

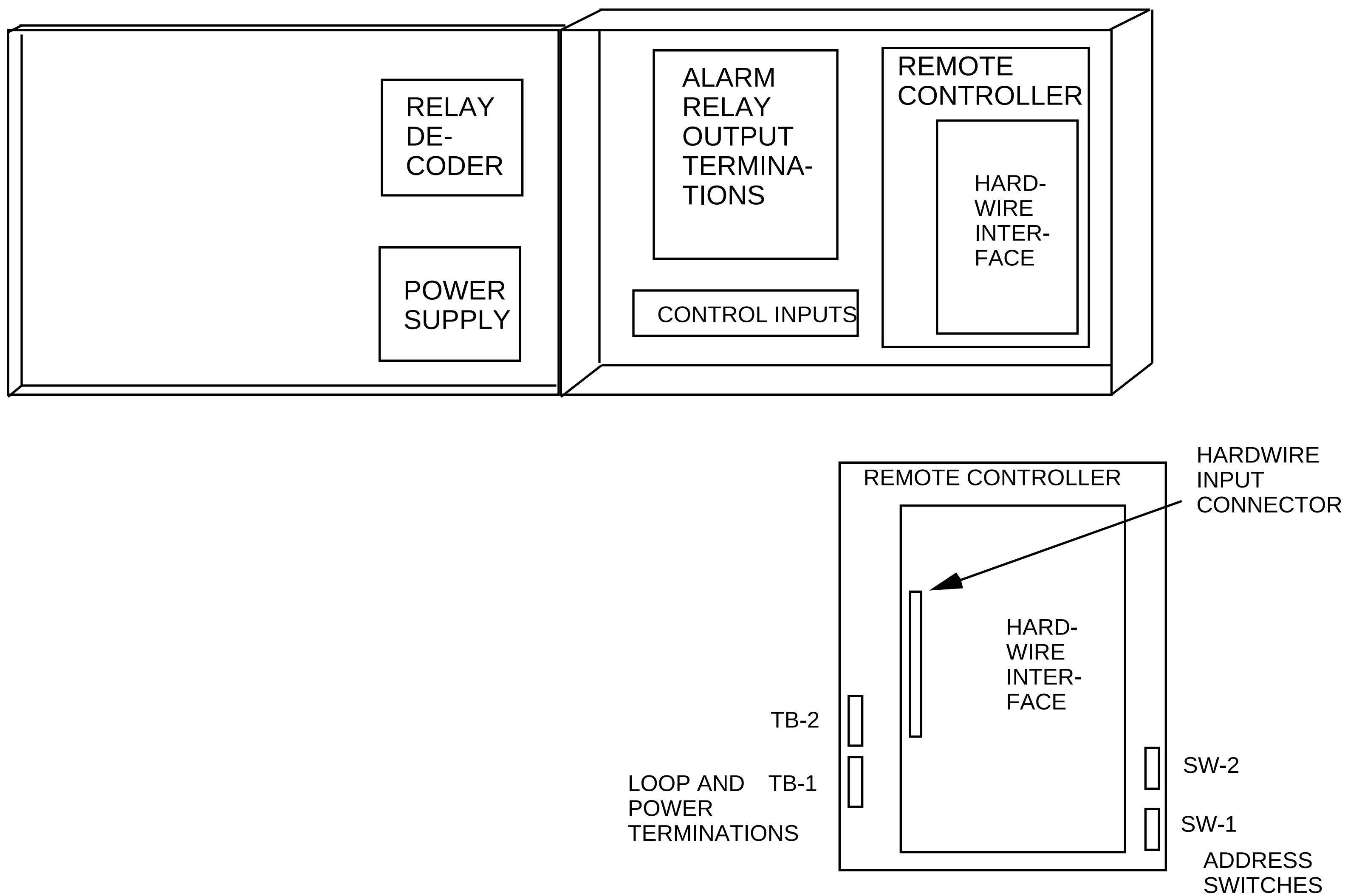


Figure 2 - 2
DCU
Equipment Locations

Output Relay	FPS	G-Line	Stand-alone	PAS 120
1	Alarm 1	Alarm 1	Input 1	Alarm 1
2	Tamper 1	Tamper 1	Input 2	Alarm 2
3	Alarm 2	Alarm 2	Input 3	Alarm 3
4	Tamper 2	Tamper 2	Input 4	Alarm 4
5	Bit 5	Bit 5	Input 5	Tamper

Table 2-1
Relay Output Functions

Input Number	FPS	G-Line	Stand-alone	PAS 120
1	Audio 2	NA	1-1	Audio 1
2	Audio 1	NA	1-2	Audio 2
3	Self-test	Self-test	1-3	Audio 3
4	Reset 1	NA	1-4	Audio 4
5	Reset 2	NA	1-5	Self-test

Table 2-2
Remote Control Functions

3.0 INSTALLATION

3.1 General

3.1.1 The Data Collection Unit (DCU) is designed to be installed in conjunction with Perimeter Products fence protection sensor systems that contain a CEnDe multiplex interface. The DCU provides the interface from the CEnDe multiplex loop to alarm and tamper relay contact points located in the DCU enclosure.

3.1.2 Since the DCU is always installed in conjunction with the other PPI fence protection equipment, the installer should thoroughly review both this manual and the manuals of the other PPI equipment before attempting a system installation.

PLEASE NOTE: Before attempting field installation, the complete security system should be interconnected and tested in your shop. Because outdoor security systems are often installed over thousands of feet, troubleshooting in the field can be very time consuming and expensive. Use the procedures shown in the initial setup and adjustment section for testing and adjustment in your shop before beginning field installation and checkout.

3.2 Initial Planning

3.2.1 Initial installation planning includes the general layout of the complete system, a determination of where each piece of equipment will be installed and where each alarm zone will be located. The initial system planning will normally be conducted in conjunction with the installation of the complete Perimeter Products fence protection system.

3.2.2 The DCU is limited to one multiplex loop of 10 processors or 20 alarm zones, and the zone configuration is fixed. Therefore, when planning the initial installation, the transponder and receiver addresses of the field processors will determine the reporting zone. For example, a field processor that is set to the zone 1 transponder and receiver addresses will have DCU alarm and tamper outputs at the zone 1 relay contacts.

3.2.3 The security system is easiest to install and service when the system design is simple and logical. The following general rules apply to installation planning:

3.2.3.1 Alarm zones typically proceed in order, clockwise, around the security perimeter, beginning at the main gate.

3.2.3.2 The FPS-2-2M and GL-M fence protection systems each contain two protection zones, which should be used in order (e.g., zones 1 and 2 or zones 11 and 12, etc.)

3.2.3.3 Since some protection zones are a considerable wiring distance from the central control point, the amount of power loss through the system wiring must be calculated in accordance with Appendix A.

3.2.3.4 The wiring used is somewhat dependent on the installation layout. Use a recommended wiring type whenever possible.

3.2.4 Figure 4-2 contains an example system layout showing a straightforward perimeter with 12 fence protection zones and one microwave zone. This is typical of most installations.

3.2.5 Brief description of Figure 4-2 :

3.2.5.1 This is a 13-zone system with one microwave and 12 FPS zones.

3.2.5.2 Zone 1 is the microwave zone. Since there is no other zone nearby, the other zone contained in the processor will not be used.

3.2.5.3 Zones 2 and 3 are served by transponder (XPO) 2, zones 4 and 5 by transponder (XPO) 3, and so on to zones 12 and 13 by transponder (XPO) 7.

3.2.5.4 Conduit connects the transponders from the central control building to each transponder on the string. For convenience and to keep the wire length as short as possible, two cables are run from control to the fence line, where it splits and runs clockwise and counterclockwise around the perimeter. No wire is needed between XPO 4 and XPO 5 because each is already connected to the loop. However, this additional connection will ensure all transponders will still work if there is a single line break in the loop (a form of Class A wiring).

3.2.5.5 Zones are established by the order of the transponders. Transponder 1 contains zones 1 and 2, transponder 2, zones 3 and 4, and so on to transponder 7 which contains zones 13 and 14.

3.2.5.6. When calculating the power loss in the field cabling, as detailed in Appendix A, you will have two strings of transponders from the central control point, as follows:

- String 1: XPO 1, XPO 7, XPO 6, XPO 5

- String 2: XPO 2, XPO 3, XPO 4.

Calculate the loss in each line and specify the correct resistor for each unit in accordance with Appendix A.

3.2.6 Detailed system planning and layout:

3.2.6.1 After studying the two examples, you should be ready to layout your system. Begin by sketching your facility installation.

3.2.6.2 Use the following symbols when laying out your system:

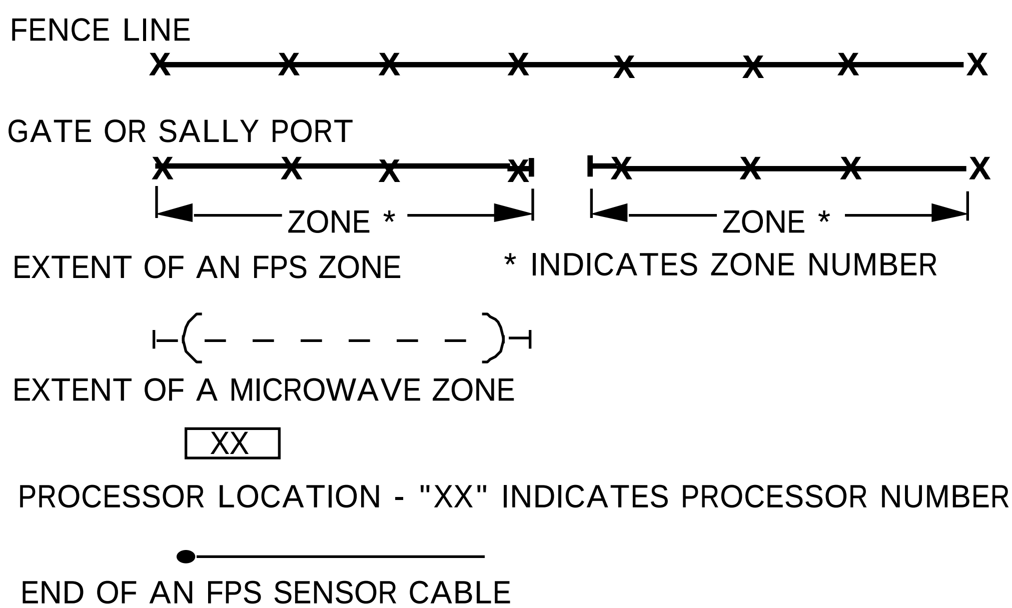


Figure 3-1
System Layout Symbols

3.2.6.3 Begin by drawing the fence lines and location of the central control building where monitoring will take place.

3.2.6.4 Now add the zone types and extents. Often this will be dictated by the customer. Number your zones if they have not already been numbered. A clockwise numbering system is usually used.

3.2.6.5 Study your plan for a moment and then place the transponders between the zones. The stand-alone microwave transponder can handle two microwave zones. Number each transponder if not already numbered. Clockwise numbering is normal.

3.2.6.6 Draw a conduit system connecting the central control point with the processors in a “daisy chain” type configuration. Refer to the examples. Label the approximate distances and lengths of each zone. This will be needed later when ordering zone sensor cable and calculating voltage drop in field cabling in accordance with Appendix A.

3.2.7 You have completed the initial planning of your installation. If you are in doubt or need further information, please contact the factory.

3.3 Mounting

3.3.1 The DCU is provided in a standard NEMA 1 style metal enclosure. The enclosure is not sealed and therefore is NOT suited for outdoor mounting. The DCU should be mounted in an electrical equipment room or other equipment or storage room that will provide suitable protection from the environment.

3.3.2 The DCU requires local power provided by a transformer furnished with the DCU unit. Locate the DCU within a short distance from the electrical power source. Observe wire size for power wiring distances that exceed 15 feet. Never use smaller than 18 gauge for power wiring.

3.3.3 The DCU is best mounted using the four mounting holes located in the corners of the enclosure. Mount the enclosure on a flat vertical wall surface, such as, a telephone type backboard. Route wiring to the enclosure in conduit when applicable. Use the conduit knockouts provided. If wiring is not in conduit, use suitable cable clamps or Heyco type strain reliefs at wiring entrances. Assure that the wiring is not used for support and is not unnecessarily strained.

3.3.4 The DCU enclosure must be provided with a suitable earth ground. The ground connection can be provided from a cold water pipe that is verified as a ground or and independent ground rod installed in accordance with the National Electrical Code.

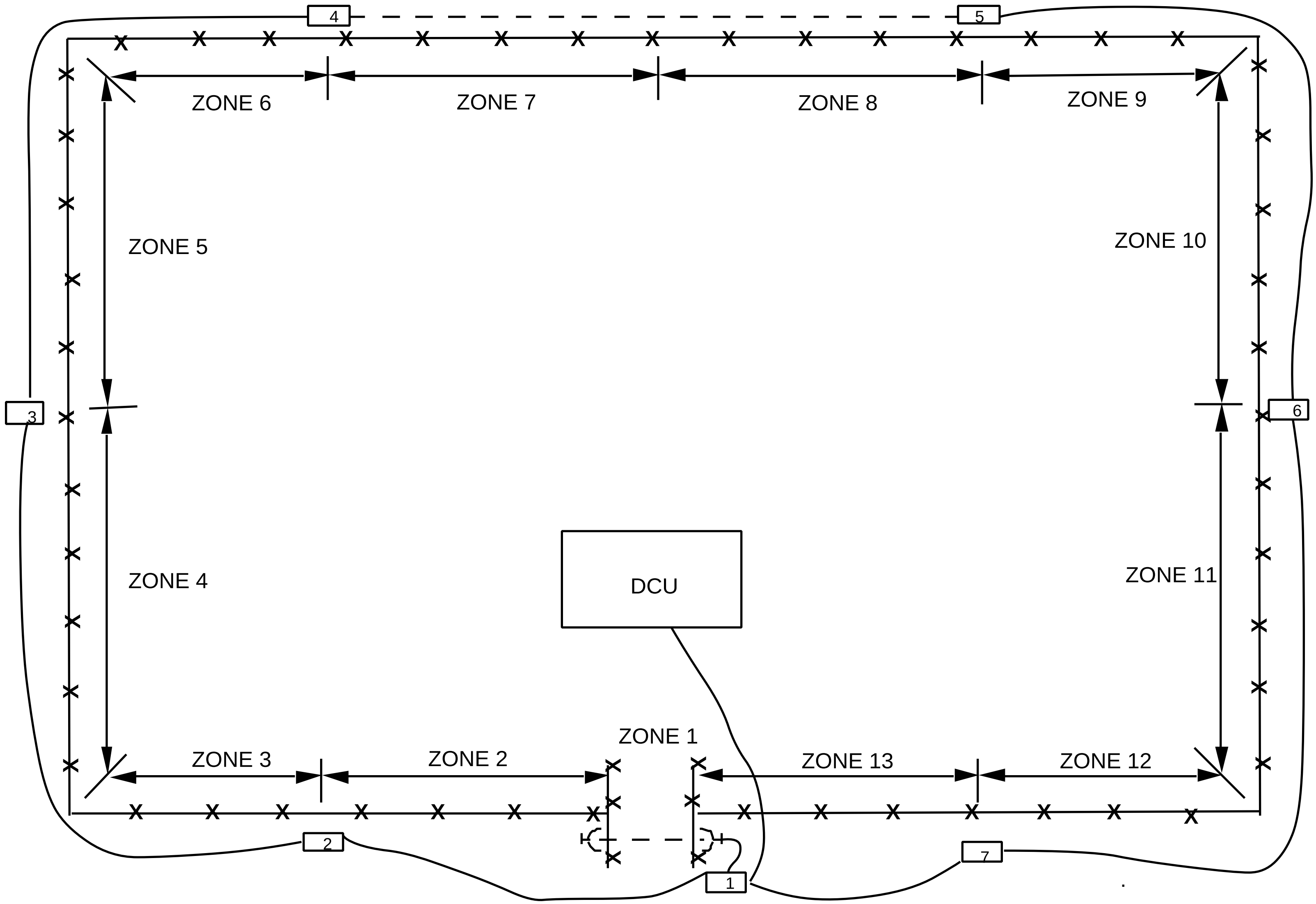


Figure 3-2   Example System Layout

3.4 Power Connections

3.4.1 Power to the DCU is provided from a separate transformer. The power supply circuit board takes the 24 VAC provided by the transformer and converts the voltage to regulated voltages for the DCU. The power supply circuit card is factory mounted on the door of the DCU enclosure. See Figure 2-2. The DCU may be powered from either 120 volt, 60Hz or 220 volt 50/60Hz. power facilities.

3.4.2 <u>OPERATION FROM 120-VOLT SERVICE.</u> The unit is correctly wired at the factory for 120-volt operation. For 120-volt operation, connect the power line to positions 1 and 4 of terminal board 1 (TB-1) of the power transformer. The MX-1000 unit (TB-1, terminals 1 and 2) is then connected to positions 1 and 2 of TB-2 of this transformer. Note that a jumper is connected between terminals 1 and 2, and between terminals 3 and 4 of power transformer TB-1 for 120-volt operation. See Figure 3-4.

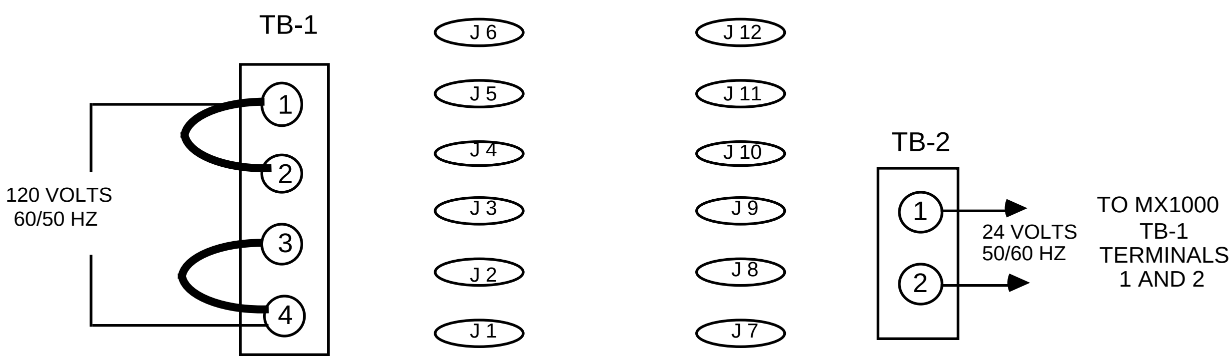


Figure 3-4
120 volt connection

3.4.3 <u>OPERATION FROM 220-VOLT SERVICE.</u> To operate the system from 220-volt services, the jumper between terminals 1 and 2 of TB-1 on the transformer assembly must be removed, and the jumper between 3 and 4 of TB-1 must be moved to terminals 2 and 3 of the same terminal board. Other connections are identical to the 120-volt operation arrangement. See Figure 3-5.

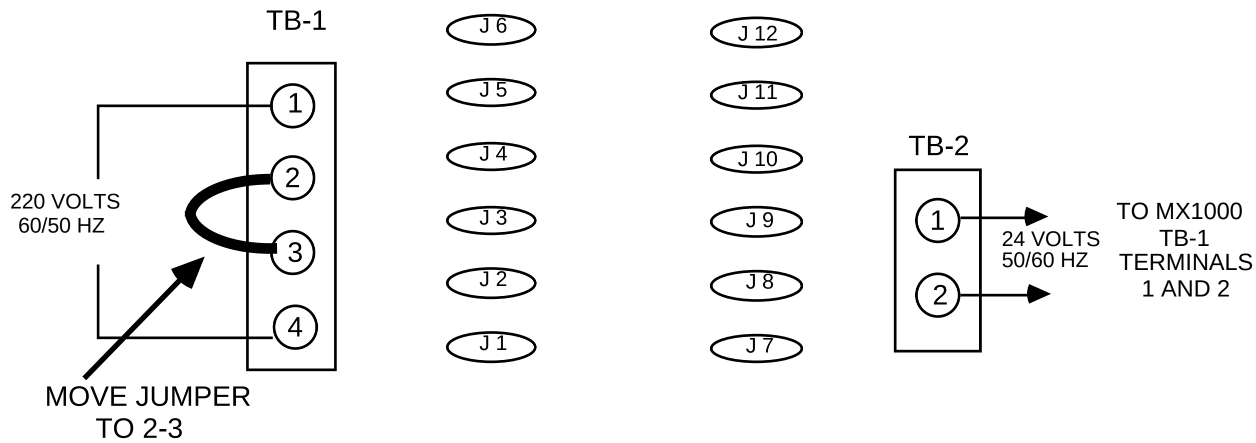


Figure 3-5
220 Volt Connection

3.4.4 The transformer output (24 VAC) cable is connected to the power input terminals located on the power supply circuit card. See Figure 2-2 for location. Figure 3-6 shows the connections to the power supply circuit card.

3.4.5 If a backup battery is required, it can be connected to the appropriate terminals on the power supply terminal strip, TB-1. See Figure 3-6.

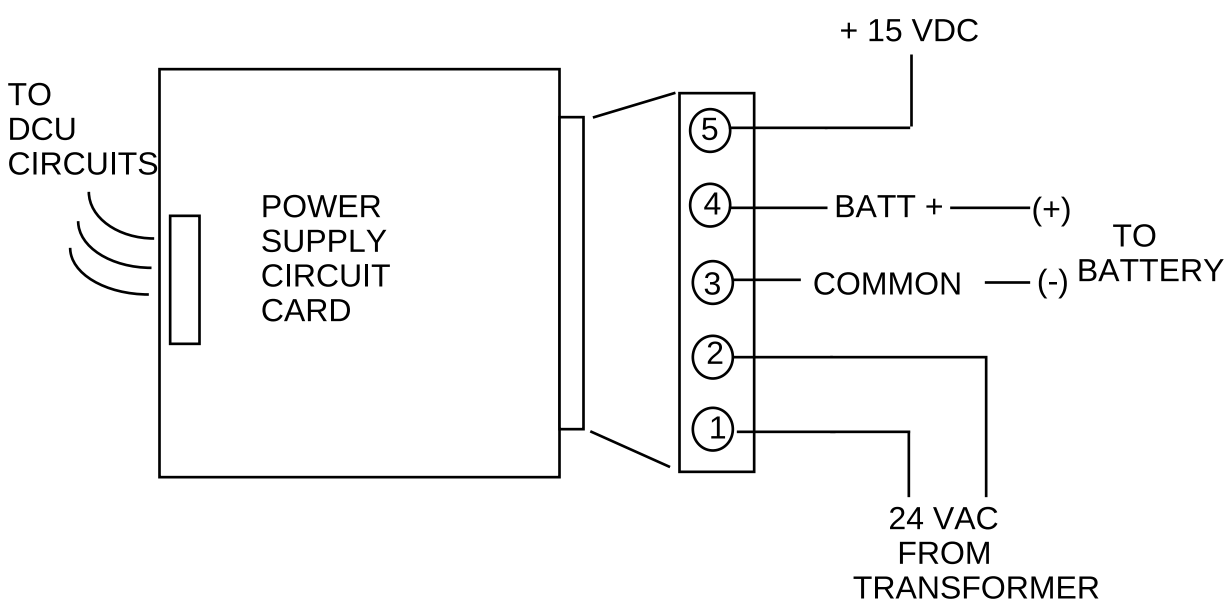


Figure 3-6
Power Supply Connections

3.5 Connection to Field Equipment

3.5.1 The DCU requires connections to the CEnDe multiplex data line from the field processors, the power line supplying power to the field processors, and from the DCU output relay contacts and command inputs to the central security system that will be monitoring the alarm system.

3.5.2 The data line and power supply connections are made to terminal board TB-1 located on the left edge of the remote controller circuit board. Figure 2-2 shows the location of the terminal board. Figure 3-7 shows the typical connections to TB-1.

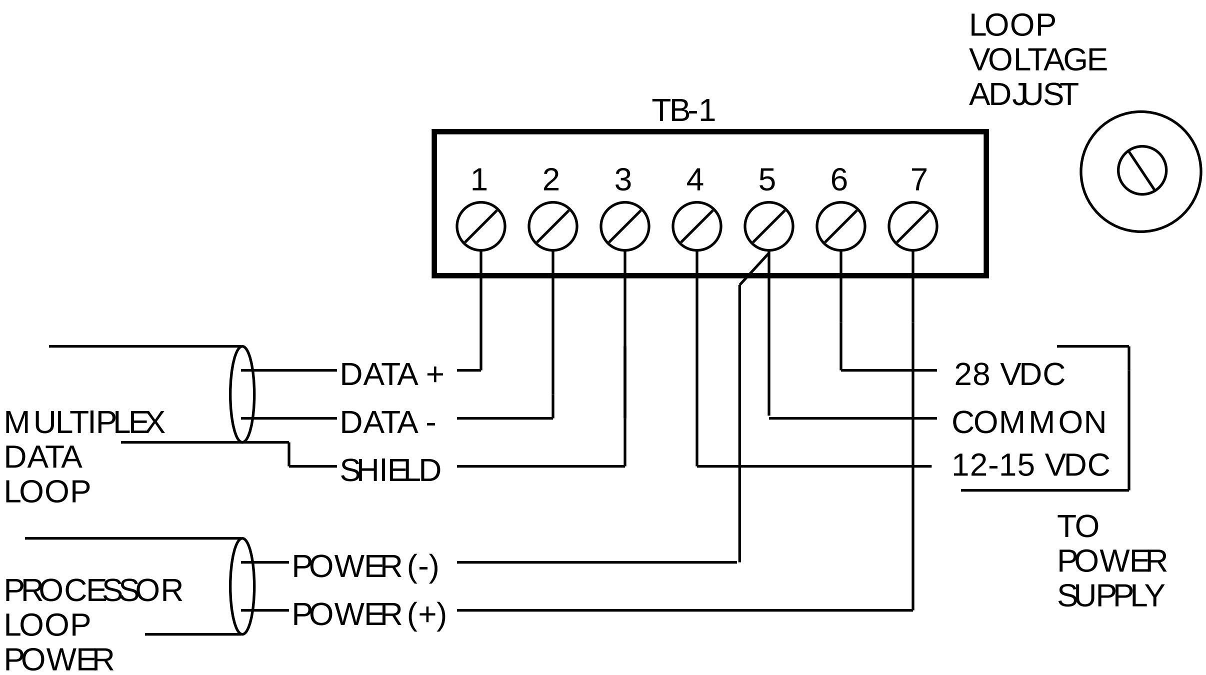


Figure 3-7
Terminal Board TB-1 Connections

3.5.3 Alarm output connections are made at the terminal strips located on the relay interface board installed to the left of the Remote Controller circuit board. See Figure 2-2 for location.

3.5.4 Figure 3-8 shows the locations of the relays, jumpers, and output terminals contained on the relay interface board. The DCU has the capability for output of up to 5 alarms coming from up to 10 field mounted transponders (XPOs). Each output is represented by a separate relay on the relay interface board. The outputs of each relay are connected to screw terminals that are labeled to match the alarm point connected to it. Figures 3-8 and 3-9 show the typical connection of alarm outputs and setting of jumpers.

NOTE: The NO/NC selection jumpers are very important since a wrong jumper setting will cause the opposite effect at the external monitoring equipment. Take the time to set the jumpers and verify jumper position at the same time that external wiring is being connected.

3.5.5 The DCU will most commonly be connected to one or a combination of four types of field transponders. These are the FPS-2-2M Fence Protection System, the GL-M 3 Wire or Multiwire Fence Protection System, the stand-alone transponder (for connecting microwave systems and equipment by other manufacturers), and the PAS-120 Personal Alarm System. Each field transponder is capable of transmitting up to 5 separate alarm signals.

3.5.6 Figure 3-8 shows the location of the alarm outputs from each transponder and the output terminal which corresponds to that alarm signal.

3.5.7 The following is a brief description of each of the alarm outputs. The types of each alarm output are dependent on the field processor as follows:.

3.5.7.1 There are five alarm outputs available from the FPS-2-2M system.

- Output 1 is the zone 1 alarm output.
- Output 2 is the zone 1 tamper output.
- Output 3 is the zone 2 alarm output.
- Output 4 is the zone 2 tamper output.
- Output 5 is the Data Bit 5 output.
  (Contact the factory for special uses of this output)

3.5.7.2 There are five alarm outputs available from the GL-M system.

- Output 1 is the zone 1 alarm output.
- Output 2 is the zone 1 tamper output.
- Output 3 is the zone 2 alarm output.

- Output 4 is the zone 2 tamper output.

- Output 5 is the Data Bit 5 output.
  (Contact the factory for special uses of this output)

3.5.7.3 There are five alarm outputs available from the stand-alone transponder.

- Output 1 corresponds to alarm input 1.

- Output 2 corresponds to alarm input 2.

- Output 3 corresponds to alarm input 3.

- Output 4 corresponds to alarm input 4.

- Output 5 corresponds to alarm input 5.

3.5.7.4 There are five alarm outputs available from the PAS-120 Personal Alarm System PARC transponder.

- Output 1 is the zone 1 alarm output.

- Output 2 is the zone 2 alarm output.

- Output 3 is the zone 3 alarm output.

- Output 4 is the zone 4 alarm output.

- Output 5 is the common tamper output.

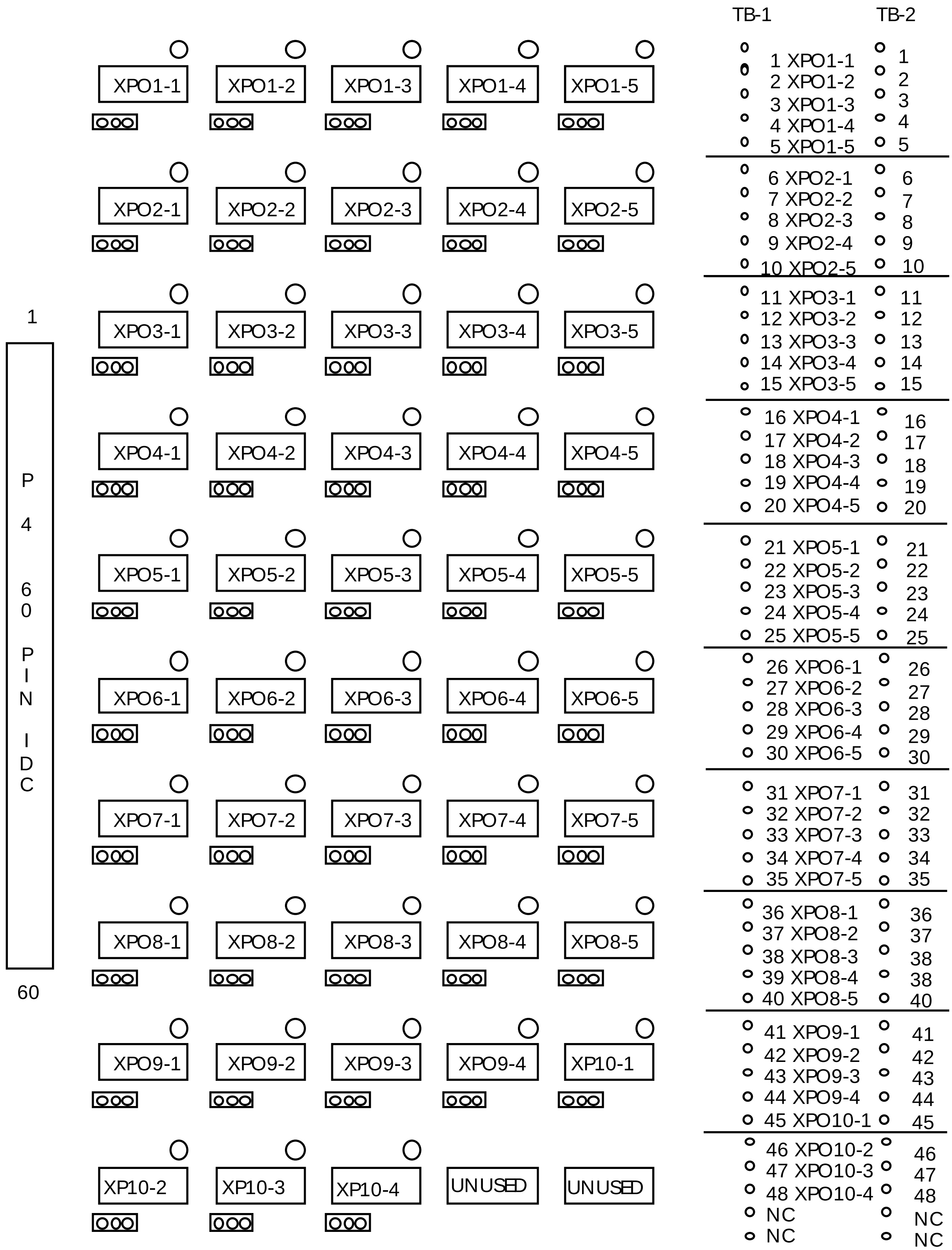


Figure 3-8
Layout of Output Terminals

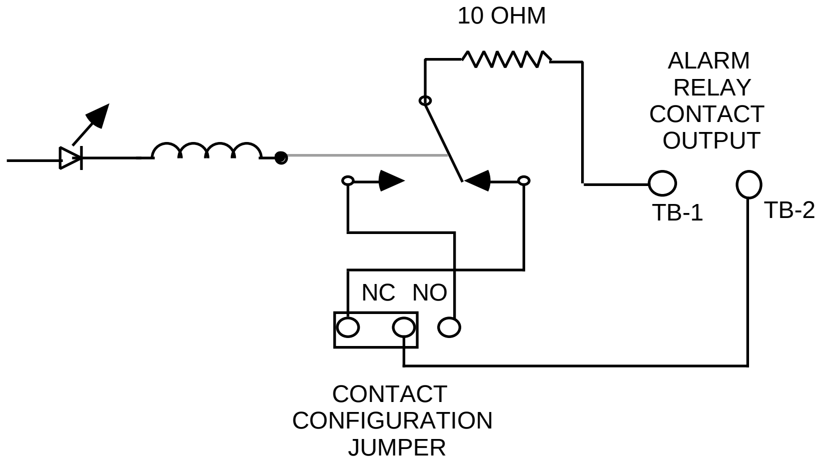


Figure 3-9
Electrical Arrangement-Alarm Relay

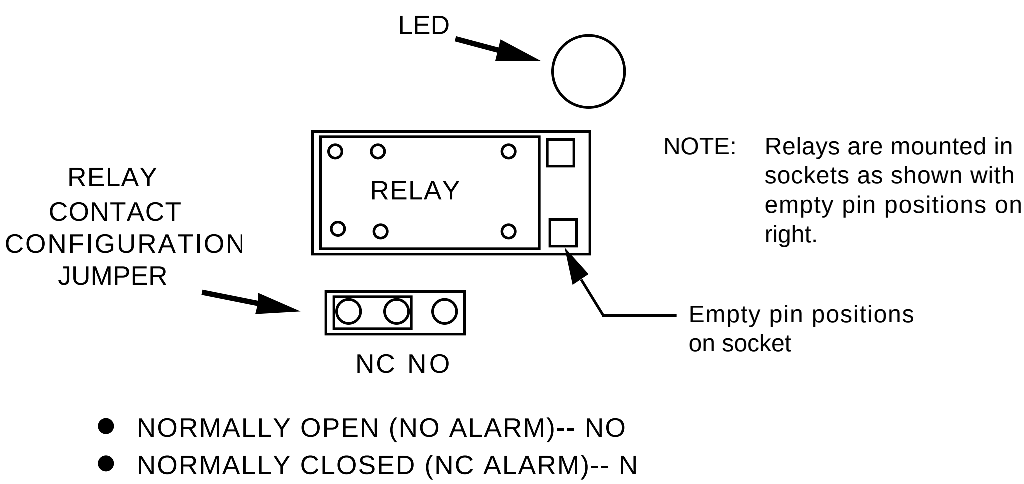


Figure 3-10
Physical Arrangement- Alarm Relay

3.5.8 Connections to the DCU command inputs are made at the 50 terminal connection strip located in the DCU cabinet below the relay interface board. Refer to Figure 2-2. The DCU is designed to interface with several types of field mounted processors and transponders. The function of the command inputs will be somewhat different depending on which processor is connected at which transponder location.

3.5.9 The DCU will most commonly be connected to one or a combination of four types of field transponders. These are the FPS-2-2M Fence

Protection System, the GL-M 3 Wire or Multiwire Fence Protection System, the stand-alone transponder (for connecting microwave systems and equipment by other manufacturers), and the PAS-120 Personal Alarm System. Each field transponder is capable of receiving up to 5 separate command inputs. Each field transponder performs a different function when the command input is activated.

3.5.10 Table 3-1 lists the types of command functions available at each transponder and the input terminal which corresponds to that command. Figure 3-11 shows the location of each input terminal.

3.5.11 The following is a brief description of the function of each of the command inputs. If you have a particular requirement for the use of these command functions. please contact the PPI factory.

3.5.11.1 There are five command inputs available for the FPS-2-2M system.

- Command input 1 activates the audio from alarm zone 2.
- Command input 2 activates the audio from alarm zone 1.
- Command input 3 activates the self test function.
- Command input 4 activates a reset of a zone 2 alarm.
- Command input 5 activates a reset of a zone 1 alarm.

3.5.11.2 There is one command input available on the GL-M system.

- Command input 3 activates the self test function.
- The other command inputs are not used with this transponder.

3.5.11.3 There are five command inputs available on the stand-alone transponder. The stand-alone transponder is most often used when control of equipment at a remote point is required.

- Command input 1 activates relay output number 2.
- Command input 2 activates relay output number 1.
- Command input 3 activates relay output number 5.
- Command input 4 activates relay output number 3.
- Command input 5 activates relay output number 4.

3.5.11.4 There are five command inputs available on the PAS-120 System.

- Command input 1 activates the audio signal from zone 2.
- Command input 2 activates the audio signal from zone 1.
- Command input 3 activates the audio self-test function.
- Command input 4 activates the audio signal from zone 3.
- Command input 5 activates the audio signal from zone 4.

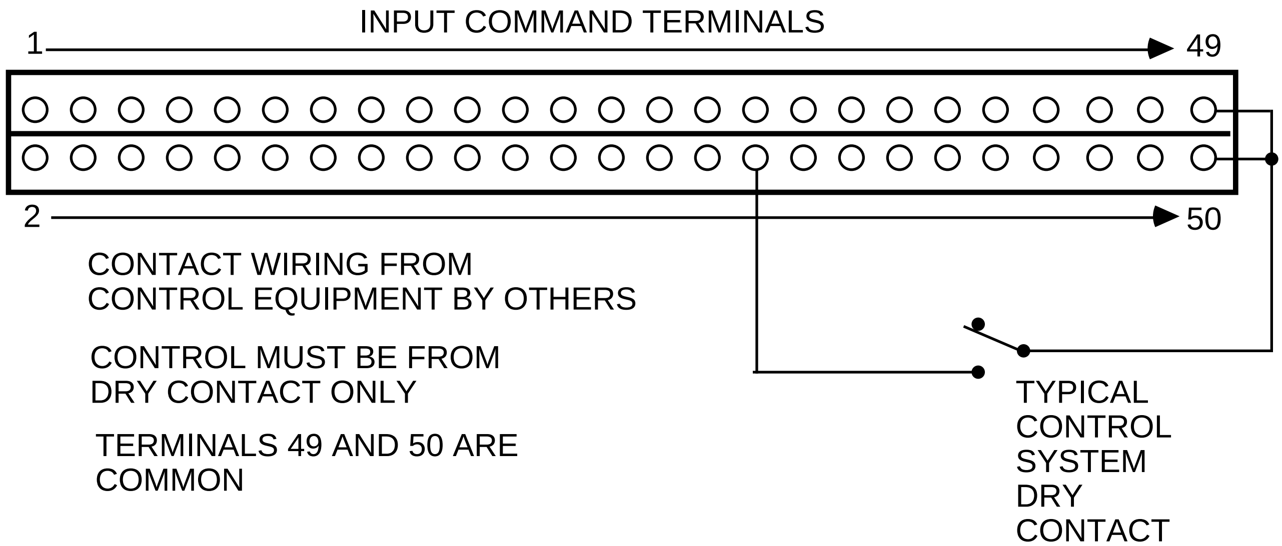


Figure 3-11
DCU Command Input Terminations

Input Number	XPO Number	FPS	G-Line	Stand-Alone	PAS-120
1	1	Audio 2	NA	1-2	Audio 2
2	1	Audio 1	NA	1-1	Audio 1
3	1	Self-test	Self-test	1-5	Self-test
4	1	Reset 2	NA	1-3	Audio 3
5	1	Reset 1	NA	1-4	Audio 4
6	2	Audio 2	NA	2-2	Audio 2
7	2	Audio 1	NA	2-1	Audio 1
8	2	Self-test	Self-test	2-5	Self-test
9	2	Reset 2	NA	2-3	Audio 3
10	2	Reset 1	NA	2-4	Audio 4
11	3	Audio 2	NA	3-2	Audio 2
12	3	Audio 1	NA	3-1	Audio 1
13	3	Self-test	Self-test	3-5	Self-test
14	3	Reset 2	NA	3-3	Audio 3
15	3	Reset 1	NA	3-4	Audio 4
16	4	Audio 2	NA	4-2	Audio 2
17	4	Audio 1	NA	4-1	Audio 1
18	4	Self-test	Self-test	4-5	Self-test
19	4	Reset 2	NA	4-3	Audio 3
20	4	Reset 1	NA	4-4	Audio 4
21	5	Audio 2	NA	5-2	Audio 2
22	5	Audio 1	NA	5-1	Audio 1
23	5	Self-test	Self-test	5-5	Self-test
24	5	Reset 2	NA	5-3	Audio 3
25	5	Reset 1	NA	5-4	Audio 4
26	6	Audio 2	NA	6-2	Audio 2
27	6	Audio 1	NA	6-1	Audio 1
28	6	Self-test	Self-test	6-5	Self-test
29	6	Reset 2	NA	6-3	Audio 3
30	6	Reset 1	NA	6-4	Audio 4
31	7	Audio 2	NA	7-2	Audio 2
32	7	Audio 1	NA	7-1	Audio 1
33	7	Self-test	Self-test	7-5	Self-test
34	7	Reset 2	NA	7-3	Audio 3
35	7	Reset 1	NA	7-4	Audio 4
36	8	Audio 2	NA	8-2	Audio 2
37	8	Audio 1	NA	8-1	Audio 1
38	8	Self-test	Self-test	8-5	Self-test
39	8	Reset 2	NA	8-3	Audio 3
40	8	Reset 1	NA	8-4	Audio 4
41	9	Audio 2	NA	9-2	Audio 2
42	9	Audio 1	NA	9-1	Audio 1
43	9	Self-test	Self-test	9-5	Self-test
44	9	Reset	NA	9-3	Audio 3
45	10	Audio 2	NA	10-2	Audio 2
46	10	Audio 1	NA	10-1	Audio 1
47	10	Self-test	NA	10-5	Self-test
48	10	Reset	Self-test	10-3	Audio 3
49		**COMMON RETURN TERMINAL**			
50		**COMMON RETURN TERMINAL**			

Table 3-1
DCU Input Command Functions

3.5.12 The DCU contains common alarm, tamper and communications failure outputs. These outputs are relay contacts that are activated whenever the remote controller board has an alarm condition on any zone, or any tamper condition on any zone, or any communications failure, respectively. These outputs appear on terminal board TB-2. See Figure 3-12 for connection information. Each local relay contact can be used as either a normally closed or a normally open contact. Circuit board jumpers are provided for each output contact. See Figure 3-12 for jumper settings.

3.6 Before going on to power up and initial testing, double check the terminations of all wiring. Loose or incorrectly connected wiring can cause equipment malfunction or failure during power up.

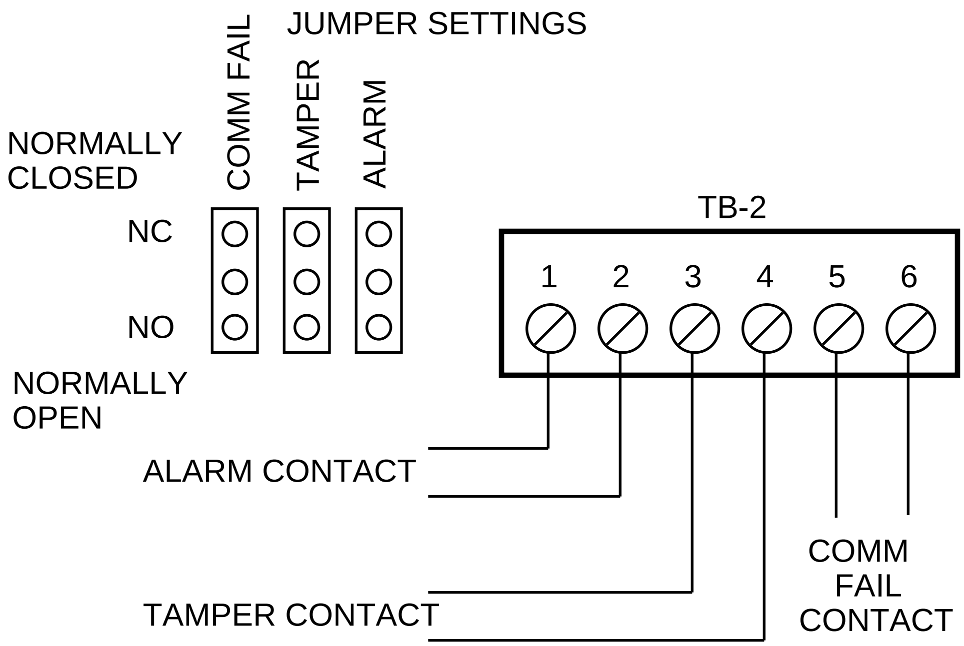


Figure 3-12
Terminal Board TB-2 Connections

4.0 INITIAL SETUP AND ADJUSTMENT

4.1 General

4.1.1 The Data Collection Unit(DCU) is the central collection and control unit for Perimeter Products fence protection systems. Therefore, the Initial Setup consists of setting the transponder and receiver addresses in each of the field processors to match those set in the DCU software. Combined with the setup procedure, a function test of each sensor is conducted to verify that all functions are operating correctly before the system is taken to the field for installation.

PLEASE NOTE: It is strongly recommended that all initial programming, adjustments and testing be accomplished in your shop. Outdoor security systems are normally installed over large areas with fences and located gates making access for adjustment and troubleshooting difficult and time consuming. Initial testing in your shop facilitates easy programming and adjustment since all equipment can be located in close proximity.

4.1.2 The following setup and adjustment procedure assumes that the setup of your DCU is being accomplished in conjunction with the setup of the complete PPI sensor system. In this regard, the DCU is a software based unit and there are very few adjustments to be made.

4.1.3 Before beginning, verify the switch settings on the Remote Controller board and the Relay Decoder Board are set correctly. Refer to Figure 2-2 for location.

4.1.3.1 The transponder address settings are all set to ON at the factory, indicating that ALL 10 field transponders will be connected. The address settings are contained on switches SW-1 and SW-2 located on the lower right side of the Remote Controller circuit board. Refer to Figure 2-2. Set the switches to indicate the number and type of transponders in your system as follows:

- The first ten switches (i.e., SW-1 switch 1 through 8 and SW-2 switches 1 and 2) are used to enable communications with transponders 1 through 10 respectively.

- In paragraph 3.2, Initial Planning, you determined the quantity and numbering of transponders in your system. You must turn ON only the address switches that correspond to the transponders in your system. Refer to Figure 4-1 for the switch layout.

- For example, If your system utilizes 8 field transponders numbered 1 through 8, switches 1 through 8 should be turned ON and switches 9 and 10 should be turned OFF. Switches 11 through 15 should be turned OFF. Switch 16 must be on at all times.

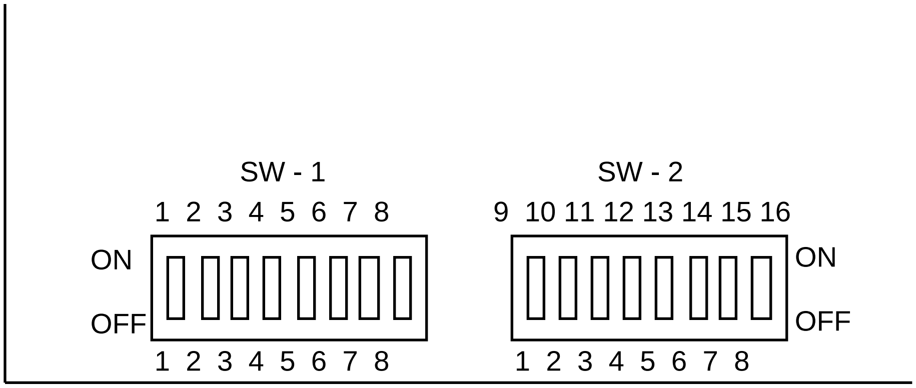


Figure 4-1
Transponder Address Switch Settings

4.1.3.2 Verify that the decoder switch settings are set as shown in Figure 4-2.

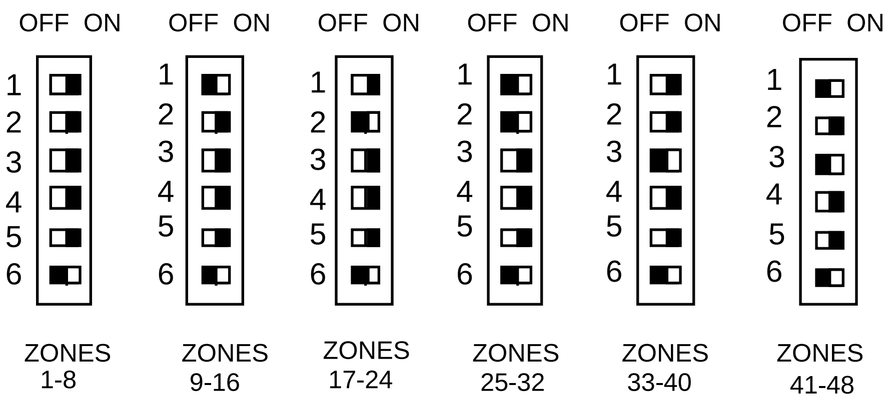


Figure 4-2
Relay Decoder Address Switch Settings

4.2 Power Connections

4.2.1 Connect the power transformer to the DCU power supply module in accordance with paragraph 3.4. Verify the terminations but do not plug in the transformer to apply power to the DCU until other connections are complete.

4.3 Connecting and Testing the Processors

4.3.1 The DCU must be connected to each of the field processors and tested for correct operation and alarm reporting. You will set the correct addresses for each of the processors and test each on the multiplex loop. When this process is complete your system components will have been tested working together and are ready for installation in the field with only minor adjustments.

4.3.2 Connect the first processor to the DCU multiplex data loop as follows:

4.3.2.1 Using a #18 twisted shielded pair cable connect the DCU data terminals TB-1, 1 (data+), 2 (data-), and 3 (shield) to the data terminals of the processor. Refer to Figure 3-6. Refer to the appropriate processor manual for the location of the appropriate terminals.

4.3.2.2 Using a #18 twisted pair, connect the DCU processor power terminals, TB-1 terminals 4 (-) and 7 (+) to the appropriate LOCAL power terminals of the processor. Refer to the appropriate processor manual and Figure 3-6. Verify that the power selection jumpers in each of the processors are in the local power (TP) position. There is one jumper for each processor zone.

4.3.2.3 Recheck connections before applying power to the DCU. Apply power by plugging in the power transformer.

4.3.2.4 Measure the power supply voltage at the power terminals of the processor under test. Adjust the sensor voltage adjust control located on the remote controller circuit board for +16 VDC. Refer to Figure 3-6 for the location of the sensor voltage adjust control.

4.3.2.5 Refer to the manual on the processor for information on setting up (dummying) each zone for bench testing. You will need to tape tamper switches into their normal (non-alarm) position and terminate sensor terminals with resistors where appropriate. This will be necessary for EVERY processor being tested.

4.4 Setting the Correct Transponder Addresses

4.4.1 At this time each transponder card should be set with the correct transponder and receive addresses that will allow proper communications with the DCU.

4.4.2 Each processor contains a transponder with a specific address that is related to the zones that the processor is reporting. The standard transponder zone assignments are shown in Table 4-1. The address switch settings for each transponder are provided in Table 4-2.

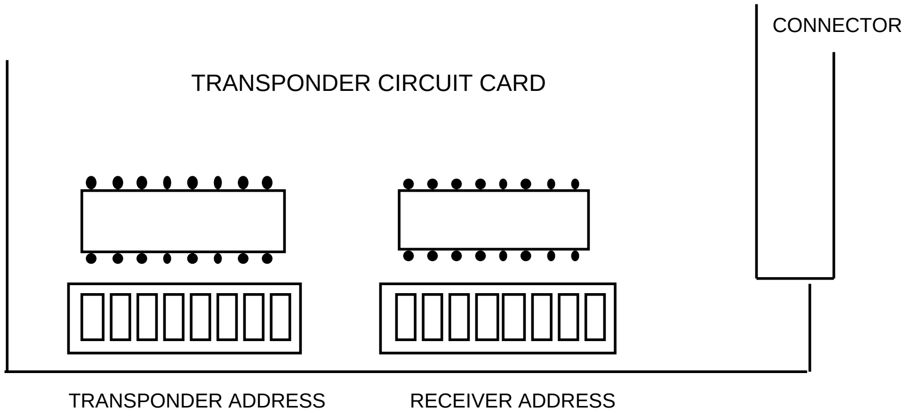
4.4.3 Set the correct transponder and receiver address for each transponder card, one at a time, and install in one of the processors. With masking tape or other suitable temporary marking material. Mark the outside of the processor enclosure with the zone numbers that this processor will be responsible for. You may also want to place temporary arrows or other markings to indicate which zone number reports in which direction of the perimeter.

4.4.4 The zone settings and locations of each transponder must match the initial site layout detailed earlier in paragraph 3.2.

4.4.5 If all processors are installed in their correct locations, there should be not need for further field programming of the processors.

TRANSPONDER 1	ZONE 1 & 2
TRANSPONDER 2	ZONE 3 & 4
TRANSPONDER 3	ZONE 5 & 6
TRANSPONDER 4	ZONE 7 & 8
TRANSPONDER 5	ZONE 9 & 10
TRANSPONDER 6	ZONE 11 &12
TRANSPONDER 7	ZONE 13 &14
TRANSPONDER 8	ZONE 15 &16
TRANSPONDER 9	ZONE 17 &18
TRANSPONDER 10	ZONE 19 & 20

Table 4-1
Transponder Zone Assignments



NOTE: Always hold the transponder circuit board in this direction when setting switches to verify that each switch is set correctly.

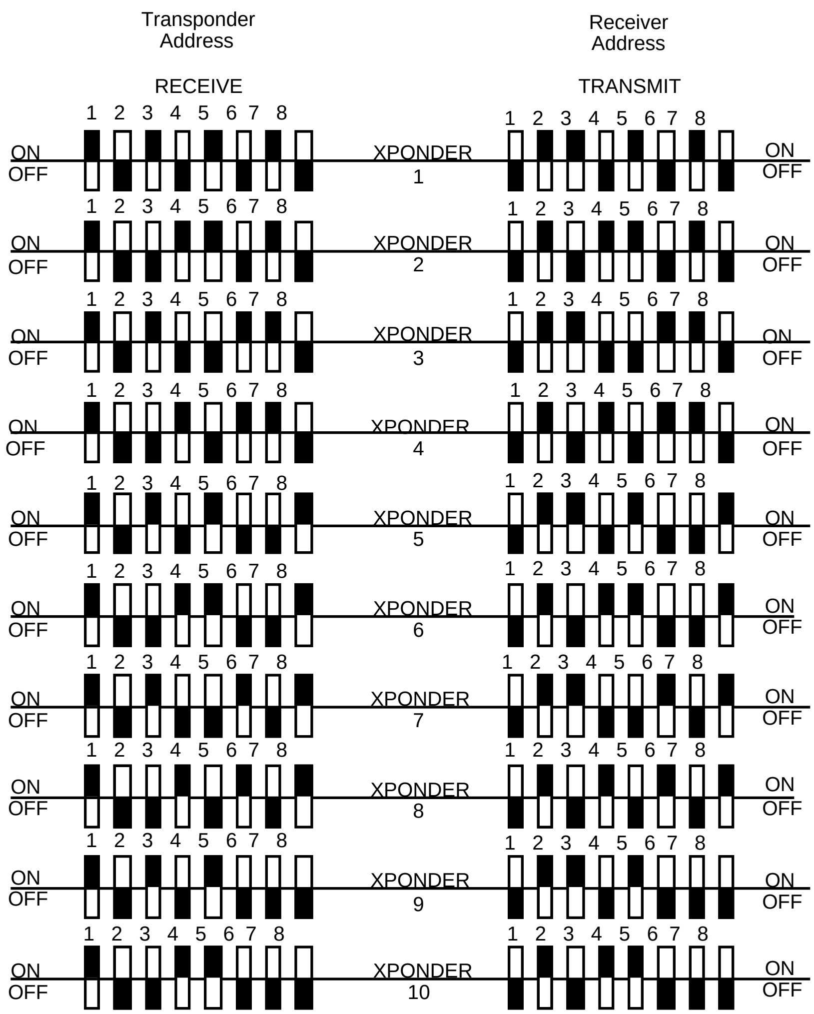


Table 4-2
Transponder Address Settings

4.5 Testing Each Processor at its Zone Address

4.5.1 Test each processor on the multiplex data loop before equipment is taken to the field for installation.

4.5.2 To test each processor, proceed as follows.

4.5.2.1 In paragraph 4.3.2 above you connected the first processor the multiplex loop. Test the first processor in accordance with 4.5.2.5 through 4.5.2.8 and then proceed to connect and test the remaining processors.

4.5.2.2 The wiring connectors on the processors are plug-in, so the existing cables can be moved from one unit to the next while each processor is tested.

4.5.2.3 Unplug the processor connector and any sensor cable or other connectors from the first processor tested. When you do this a Comm Failure alarm will appear. Plugging in another processor will clear the Comm Failure.

NOTE: A communications failure is indicated by the closing of the Comm Failure relay. You can visually inspect the Comm Failure relay or measure the resistance at terminal strip TB-2, terminals 5 and 6. When measuring the resistance verify the position of the jumper settings. Refer to Figure 3-11.

4.5.2.4 Plug the processor connector and any sensor cable or other connectors in the proper terminations of the next processor to test.

4.5.2.5 If the processor and transponder card is operating properly there should be no lighted LEDs on the relay interface board (indicating an alarm or tamper condition), corresponding to the zones assigned to that processor.

4.5.2.6 Simulate an alarm on one or more processor zones. An alarm will be indicated by the lighting of the alarm and/or tamper LED located adjacent to the relays corresponding to the zones for this processor.

4.5.2.7 If the operation is not as described, verify the transponder and address switch settings on the transponder card. Check the power supply voltage for the +16VDC. If a problem still exists, swap the transponder card with another with the same switch settings. If the problem continues, replace the processor with another. If the problem still exists, contact the factory for assistance.

4.5.2.8 Unplug the tested processor and replace with one of the units remaining to be tested.

4.5.2.9 Proceed through the steps in paragraphs 4.5.2.4 through 4.5.2.8 for each of the remaining processors.

4.5.2.10 Upon the completion of this testing, each processor and the DCU will have been tested together and are communicating properly. This testing should not have to be repeated during the field installation.

4.5.2.11 The initial testing and adjustments are complete. You should disconnect your test setup and install the front covers on all processors, verify that each is labeled with the proper zones and set them aside ready for field installation.

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5.0 SYSTEM STARTUP AND TESTING

5.1 General

5.1.1 This section of the manual covers the start up and testing of the field installed system.

5.1.2 This section assumes that the DCU and associated processors have been setup and programmed in the shop in accordance with manual section 4. The DCU has been installed in the field in accordance with manual Section 3 and that the alarm processors and sensors including interconnecting cabling have been installed in accordance with the appropriate installation and operation manuals.

5.2 Applying Power

5.2.1 In most cases, the DCU provides the power source for all field processors and sensors.

5.2.2 Before applying power to the DCU, verify with an ohmmeter that the power and data wiring for the external multiplex loop are not shorted or grounded.

5.2.3 Verify that all connections to the DCU are secure. Verify that all connections to external control room mounted equipment are secure.

5.2.4 Verify the connection of the ground terminal to a suitable electrical ground. This ground must be an independent ground rod or a water pipe in accordance with the National Electrical Code.

5.2.5 Apply power to the DCU by plugging in the modular transformer. The transformer should be plugged into an approved plug strip containing suitable transient suppression.

5.2.6 Connect the backup battery to the DCU terminals in accordance with Figure 3-5.

5.3 Loop Voltage Adjustments

5.3.1 The DCU multiplex loop connects the DCU to the processors located on the perimeter of the facility. Due to the wiring distances and the number of transponders that can be installed on a loop, there can be significant voltage drop between the DCU and the last processor in a loop.

5.3.2 The processors are designed to compensate for some of the voltage variation. However, the voltage at any processor cannot be lower that 12 volts or more than 16 volts. This procedure will allow you to check the voltage on each loop and make adjustments to assure proper operation of all sensors.

5.3.3 If you completed your power distribution calculations in accordance with Appendix A, you arrived at a value for V_{pp}, the required value for the voltage from the DCU. The voltage should be a minimum of 12 volts and a maximum of 24 volts. If your value is not within these limits, recheck your calculations. Call the factory for assistance if necessary.

5.3.4 The value of V_{pp} you calculated for the external multiplex loop can be set in the DCU at this time.

5.3.4.1 Open the DCU enclosure to gain access to the loop voltage adjustment.

5.3.4.2 Attach a multimeter to TB-1 terminals 4(-) and 7(+) located on the remote controller circuit board. Refer to Figures 2-2 and 3-6.

5.3.4.3 The voltage measured at the test point should be +16 VDC since you set this voltage during the initial in-shop testing and programming.

5.3.4.4 Using a suitable small screwdriver, adjust the sensor voltage adjust potentiometer until the voltage at the test point reads the voltage you calculated for the loop as indicated in paragraph 5.3.3 above.

5.3.5 The voltage at each of the processors in the field must be checked to verify that the voltage at each location is a minimum of 12 VDC and not more than 16 VDC. Proceed as follows:

5.3.5.1 Go to the furthest processor and measure the incoming voltage, +PP, where the power cable connects to the processor. This processor should have no dropping resistor. Utilize the same multimeter as used for adjusting the loop voltage inside the DCU.

5.3.5.2 The voltage should be not less that 12 VDC. If the voltage at this point is lower than 12 VDC, the voltage at the DCU must be raised by the amount that will allow the voltage at the end processor to be raised to 12 VDC. For example, If the measured +PP voltage at the end processor is 11.2 VDC, there is a 0.8 volt difference and the DCU loop output voltage must be raised 0.8 VDC to compensate.

5.3.5.3 Return to the DCU and readjust the loop sensor voltage as indicated in paragraph 5.3.4.4 adding the difference voltage that you measured at the end processor.

5.3.5.4 Return the end-of-line processor and verify that the voltage is a minimum of 12 VDC. If the voltage is not a minimum of 12 VDC, recheck the field wiring and repeat the steps in paragraphs 5.3.5.1 through 5.3.5.3.

5.3.5.5 Some of the other processors probably needed resistors installed to make sure their voltages are between 12 and 16 VDC. You have probably already installed these resistors in each processor during installation in accordance with paragraph 3.2 If for some reason you have not, review paragraph 5.3.3 and Appendix A before proceeding.

5.3.5.6 Measure the voltage at the power supply terminals of each processor. If the dropping resistor has been installed, measure the voltage at the appropriate power supply pins of the processor, i.e., on the processor side of the resistor.

5.3.5.7 The voltage at each processor must be a minimum of 12 VDC and a maximum of 16 VDC. If this is not the case at any processor, refer to paragraph 5.3.5 and Appendix A, and install the correct value of resistor to make the voltage fall within the correct range.

5.3.6 At this point, the voltages of the external multiplex loop have been adjusted and you are ready to proceed with system troubleshooting and testing.

5.4 Resolving Communications Problems

5.4.1 The DCU should be communicating with all processors at this time. A communications failure is indicated by the closing of the Comm Failure relay. You can visually inspect the Comm Failure relay or measure the resistance at terminal strip TB-2, terminals 5 and 6. When measuring the resistance verify the position of the jumper settings. Refer to Figure 3-11.

5.4.2 Zones that are showing Comm Failure will also show alarm and tamper outputs. If there are, this means that the zones showing Comm Failure are not communicating with the DCU. Proceed through the steps below to determine what the problem may be.

5.4.2.1 Inspect the wiring at the suspect processors for broken or loose connections.

5.4.2.2 Inspect the transponder and receiver codes at the suspect processors.

5.4.2.3 Review the Initial System Planning in Section 3. Verify that each zone has been properly designated and programmed.

5.4.2.4 If after performing the steps above, you are continue to have a Comm Failure problem, contact the factory.

5.5 Initial Testing

5.5.1 At this point, all processors should be communicating with the DCU, but there may be still some alarms coming from the processors. These may be obvious (i.e., tamper alarm because the processor faceplate is removed for testing, or an alarm defect that must be repaired).

5.5.4 Refer to the processor manual for the testing criteria. Test each processor in accordance with the manual.

6.0 MAINTENANCE

6.1 General

6.1.1 The DCU once installed is normally part of the total security system. The DCU and fence protection processors should be periodically tested as part of the complete system. Refer to the manuals for the processors and sensors to determine how testing should be conducted.

6.2 Special Requirements

6.2.1 The facility management may have requirements and procedures that require additional maintenance and testing beyond those listed herein.

6.2.2 If questions arise about maintenance and testing, please contact your factory representative.

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7.0 TROUBLESHOOTING

7.1 Systematic Testing

7.1.1 Problems sometimes occur due to equipment failures. However, in most cases, problems are caused by human or installation related items. Several of these items are:

Shipping damage
Disturbed wiring or connections
Incorrect connections
Physical damage
Defects in the fence mechanical installation

7.1.2 Always look for the simplest problem first. For example, always check for power supply voltages before starting any further testing.

7.1.3 When approaching a system malfunction, look first for a related activity that could have caused the problem. This will help you go directly to the possible problem areas and/or obtain more accurate factory assistance. Examples are:

Recent maintenance actions or installations of other equipment in the same area or equipment rooms.

Water or lightning damage.

7.1.4 Factory customer assistance is available to help you find and correct system errors. It is important that you keep your as-built documentation and test records so the factory will have the data needed to help resolve your problem.

7.2 Problem Identification and Resolution

7.2.1 Table 7-1 is provided to help you find and resolve system defects. The DCU is the control unit for the entire fence protection system; therefore, defects reported on the DCU may be problems in the other equipment. Be sure to refer to the technical data for the other equipment as well. Before proceeding further, check all power supply voltages, both at the DCU and at any questionable field-installed processors.

7.3 Repair

7.3.1 Perform system repairs using good commercial practice. It is recommended that repairs be performed by personnel who have received factory training in both the DCU **AND** the alarm processors used in the installation. Improper repairs or system damage caused by untrained personnel can affect warranty.

7.3.2 Isolate defective components by swapping field connections with known good components or by using spare components reserved for maintenance actions. Repairs to equipment and circuits contained inside the DCU are not recommended in the field unless authorized by a factory technician. Consult the factory before attempting testing inside the DCU or removing DCU internal components. Perform testing and repair of field-installed components in accordance with the applicable manuals.

7.3.3 Return components thought to be defective to Perimeter Products for repair in accordance with the repair procedure. Include information describing the nature of the problem with the component to be repaired. This will shorten the factory repair time.

TABLE 7-1
TROUBLESHOOTING GUIDELINES

SYMPTOM	POSSIBLE CAUSE	RECOMMENDED SOLUTION
COMM Failure in one zone	Defective sensor or processor	Refer to manual for processor and sensor
	Defective DCU	Set another processor to the code of the defective unit and retest
COMM Failure on all zones	Loose wiring at DCU	Check wiring
	Defective wiring on loop	Disconnect and test for opens, shorts, and/or grounds
Irratic alarms or tamper alarms from one or more processors	Defective sensor, processor or fence	See processor manual for troubleshooting procedure
No power at DCU power supply or processor power terminals	AC main power lost	Check circuit breakers and AC input wiring for correct voltage
	Power supply defective	Check fuse located in DCU transformer assembly. If fuse is blown check DCU before installing new fuse

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Multiplex Loop Power Distribution Calculations

1.0 General

1.1 The DCU in most cases provides the power for all the field processors that are connected to it. Providing the system power from one central location (the DCU) enables full control of the system from central control and simplified battery backup.

1.2 However, providing the power to the field units from the central location causes a voltage drop in the power feed line because of the long distances normally encountered in the installation of a perimeter protection system.

1.3 The field processors and the DCU are designed to compensate for the voltage drop over very long distances. Additional voltage compensation in the form of dropping resistors needs to be installed at some processors on a long external multiplex loop.

1.4 The procedure contained in this Appendix enables you to quickly calculate the voltage drop on a loop of any length and with any number of processors. The result of these calculations will be:

1.4.1 The value of one of three resistor values to be installed at selected field-installed processors will be determined.

1.4.2 The output voltage level at which the DCU external multiplex loop should be set will be determined.

1.4.3 The values of the calculated loop voltage at each processor will be determined. These can be used to double check your installation during Initial System Testing.

2.0 Loop Power Distribution Calculations

This design approach uses engineering approximations to simplify the calculations. The accuracy of the approximations are sufficient to allow proper operation of the system.

The resistance (Rc) between any two transponder (XPO) locations depends upon the distance between these locations as follows:

Rc = (14) (Dc) for #18 wire
where Dc is the distance between two XPOs in thousands of feet.

For Example:

Rc = 14 (2) = 28 ohms if the XPO locations are the maximum 2000 feet apart.

3.0 Procedure

The voltage at the XPO, which is the farthest cable distance away from the MX-1000, is set to the minimum voltage of 12 volts. The voltage drop between the furthest XPO and next closest XPO (XPO 2) is calculated assuming a flow of 30 ma through the resistance of the cable since the typical processor requires a 30 ma current.

Vc1 = (0.03) (14Dc1) = (0.03) (28)
= 0.84V for 2000 ft. spacing

The voltage at XPO 2 is then the voltage at XPO 1 (or node 1) plus the drop between XPO 1 and 2 (Vc1 above).

V2 = V1 + VC1
= 12 + 0.84 = 12.84 volts

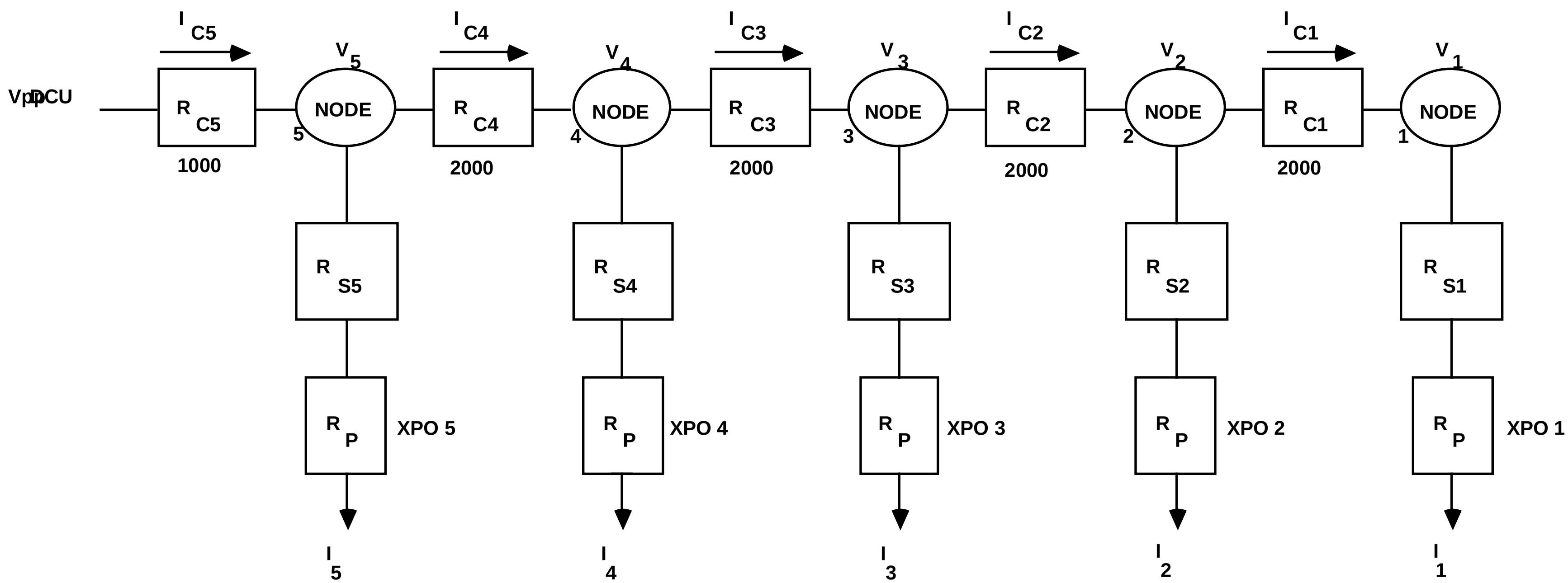
Shorter distances will result in less voltage drop.

This procedure is carried out in turn for each sector position and the voltage at each location is determined. This node voltage will appear at TB 1-7 (+) and 8 (-) of each processor connected to the Comm Bus. A series resistor (Rs) is connected between processor TB 1-5 and the field wiring to reduce this node voltage (the processor voltage) to a value between 12 and 16 volts.

<u>Selection of Rs</u>
The series resistance Rs is determined as follows:

If:	$12 \le Vs \le 16$	Rs = 0
	$16 < Vs < 18$	Rs = 100 ohms
	$18 < Vs \le 21$	Rs = 200 ohms
	$21 < Vs < 24$	Rs = 300 ohms

The following example shows the power distribution of a typical maximum sector length system of five processors (10 zones), spaced 2000 cable feet apart, with the DCU located 1000 cable feet from the closest processors.



$I_{C1} = I_1$

$I_{C2} = I_1 + I_2$

$I_{C3} = I_1 + I_2 + I_3$

$I_{C4} = I_1 + I_2 + I_3 + I_4$

$I_{C5} = I_1 + I_2 + I_3 + I_4 + I_5$

$V_1 = 12V$

$V_2 = V_1 + V_{C1}$

$V_3 = V_2 + V_{C2}$

$V_4 = V_3 + V_{C3}$

$V_5 = V_4 + V_{C4}$

$V_{PP} = V_5 + V_{C5}$

WHERE:

$R_C = D K_R$

R_C … RESISTANCE

D … DISTANCE BETWEEN …

K_R … COEFFICIENT OF … SECTORS

Figure A-1

Power Distr

The design for this system will establish the following:

(1) The voltage at each node (TB 1-5 with respect to TB 1-6, which is the power input to the processor).

(2) The value of the additional series resistor (Rs) if required.

(3) The voltage required at the output of the DCU (V_{pp}).

The design routine is as follows:

(1) Draw the equivalent resistance network (see Figure A-1)
(2) Set V1 = 12 volts
(3) Calculate Vc1 (voltage drop by cable between XPO 1 and XPO 2) with 30 ma (current flowing between node 1 and node 2) through 28 ohms (resistance of Cable #1 between XPO 1 and XPO 2)
    Vc1 = (I1) (Rc1) = (0.03) (28) = 0.84V
(4) Calculate V2 (voltage at node 2)
    V2 = V1 + Vc1 = 12 + 0.84 = 12.84V
(5) Calculate Ic2 (current thru cable #2)
    Ic2 = I1 + I2 = 0.03 + 0.03 = 60 ma
(6) Calculate Vc2
    Vc2 = (Ic2) (Rc2) = (0.06) (28) = 1.68V
(7) Calculate V3
    V3 = V2 + Vc2 = 12.84 + 1.68 = 14.52
(8) Calculate Ic3
    Ic3 = I1 + I2 + I3 = 0.03 + 0.03 + 0.03 = 90 ma
(9) Calculate voltage drop across Rc3
    Vc3 = (Ic3) (Rc3) = (0.09) (28) = 2.52V
(10) Calculate V4
    V4 = V3 + Vc3 = 14.52 + 2.52 = 17.04V
(11) Calculate Ic4
    Ic4 = I1 + I2 + I3 + I4 = (4) (0.030) = 120 ma
(12) Calculate voltage drop across Rc4
    Vc4 = (Ic4) (Rc4) = (0.12) (28) = 3.36V
(13) Calculate V5
    V5 = V4 + Vc = 17.04 + 3.36 = 20.4V
(14) Calculate Ic5
    Ic5 = I1 + I2 + I3 + I4+ I5 = (5) (0.03) = 150 ma
(15) Calculate voltage drop across Rc5
    Vc5 = (Ic5) (Rc5) = (0.15) (14) = 2.1V
(16) Calculate the Processor Power voltage (V_{pp}) from the DCU
    V_{pp} = V5 + Vc = 20.4 + 2.1 = 22.5V
(17) Set Rs = 0   For all node voltages greater than 12V but less than 16V

Set Rs = 100 ohms For node voltages greater than or equal to 16V but less than 18V
Set Rs = 200 ohms For node voltages greater than or equal to 18V but less than 21V
Set Rs = 300 ohms For node voltages greater than or equal to 21V but less than or equal to 24V

V1 =	12.0V	therefore	Rs1 = 0
V2 =	12.84V	therefore	Rs2 = 0
V3 =	14.52V	therefore	Rs3 = 0
V4 =	17.04V	therefore	Rs4 = 100 ohms
V5 =	20.4V	therefore	Rs5 = 200 ohms

To implement this design, the DCU output voltage (V_{pp}) should be set to 22.5V and a 100 ohm resistor should be installed in series with pin 5 of the fourth Processor TB 1, and a 200 ohm resistor should be installed in series with pin 5 of the fifth Processor TB 1. Processors 1, 2 and 3 are wired directly to the power bus.