CAT2

Installation and Programming Manual

This Manual describes the CAT2, its uses and set up. It also describes the use of the CATSW programming software.

Effective: 13 March, 1998

NR&D
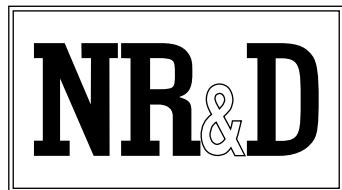
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Introduction

The Niobrara CAT2 is a serial communication translator intended to allow Modicon PLCs to participate on a Square D RNIM radio network by translating the RNIM messages into Modbus RTU. The CAT2 includes two 9-pin RS-232 serial ports: one DE9S (female) and one DE9P (male). The female port operates as a RNIM Slave and is to be connected to a radio modem. The male port operates as a Modbus RTU Master and is to be connected to a serial port on the Modicon PLC. This selection of gender on the serial ports allows the use of a standard programming cable from the CAT2 to the PLC as well as a standard Modbus modem cable from the CAT2 to the radio.

The two serial ports are independently configurable for baud rate and parity. Port 1 also includes settable parameters for the RNIM drop number, Network ID, and CTS delay. Port 2 includes settings for downstream timeout and options for Read/Modify/Write operation for bit-masked SY/MAX non-priority WRITEs and spoofing of POWERLOGIC SMS reads of register 8188. These parameters are saved into EEPROM for nonvolatile storage. A MS-DOS compatible program, CATSW, is provided with the module for ease of configuration.

Figure 1-1 shows the key physical features of the CAT2. The CAT2 is mounted on a standard 35mm din rail.
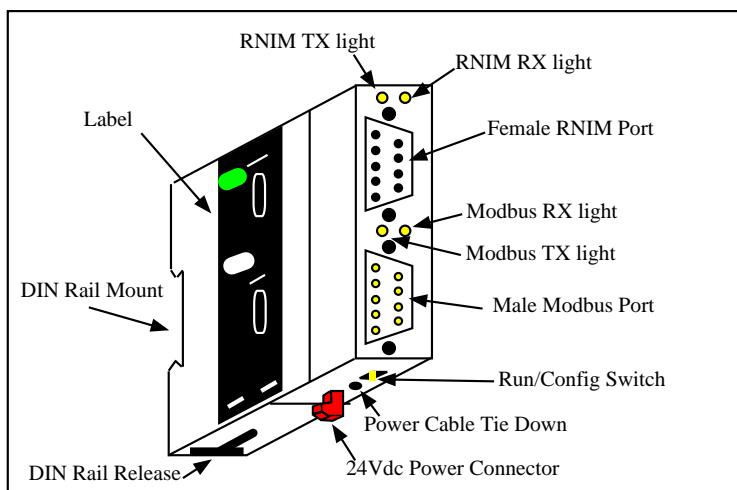
Figure 1-1   CAT2 Feature View

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Installation

CATSW Installation

1   The CATSW software is included on a 3.5" 1.2M MS-DOS diskette along with all NR&D PLC related software. For ease of installation, use the INSTALL program on the floppy. Select the CATSW file for installation and allow the INSTALL program to perform the decompression.

2   To manually install CATSW, run the PKUNZIP program with the following parameters:
         A:>PKUNZIP -d CATSW.ZIP C:\CAT2*.*
     This will run PKUNZIP from the floppy, create the directory CAT2 on the c drive, expand all files from CATSW.ZIP into the \CAT2\ directory.

3   To start the CATSW after installation, perform the following:

         > C:

         > CD \ CAT2

         > CATSW

     The screen should look like Figure 2-1.
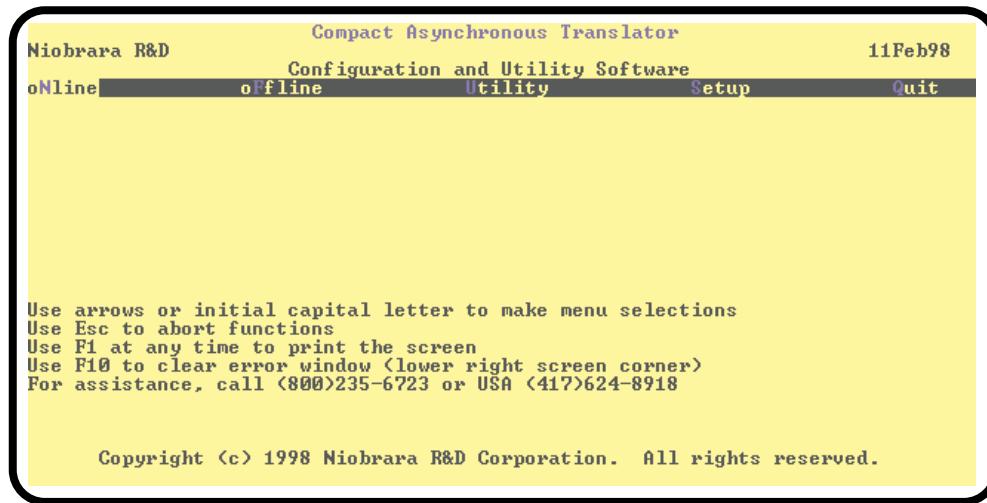
Figure 2-1   CATSW Startup Screen

4   Press S for Setup. A sub-menu will appear which allows the selection of the Sy/Max connection or Terminal Emulator Connection configuration parameters. These setup parameters affect only the configuration of the personal computer, not the CAT2.

5   Press S for Serial Port. The screen should appear as in Figure 2-2.

6   Select the COM port of the personal computer to be used to configure the CAT2 by pressing the space bar until the appropriate COM port is shown. Then press ENTER.

7   When the configuration parameters are entered, press Enter until a window appears to prompt to save the setup to disk file. Press Y for yes.

The CATSW configuration software is now installed and ready for communication to the module. For more information about the setup parameters of CATSW see page 33.
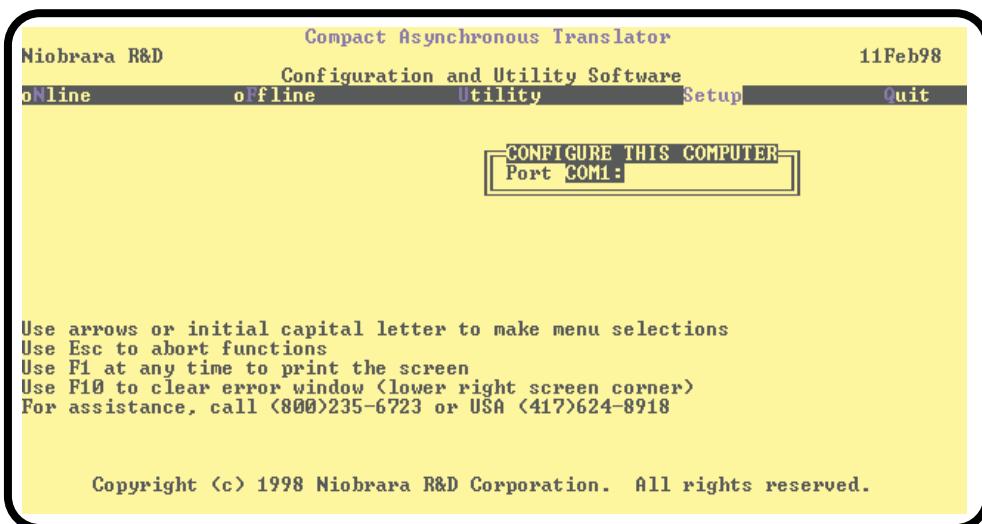
Figure 2-2   CATSW Serial Port Configuration Screen

CAT2 Installation

1   Place the CAT2 on the top edge of the DIN rail as in Figure 2-3.

2   Rotate the CAT2 down to snap the catch on the DIN rail.

3   Connect a suitable +24VDC power supply to the CAT2 as in Figure 2-4. .
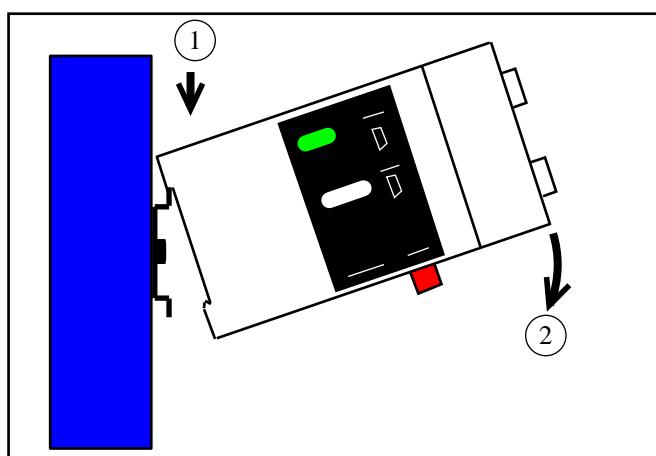
Figure 2-3   DIN Rail Mounting
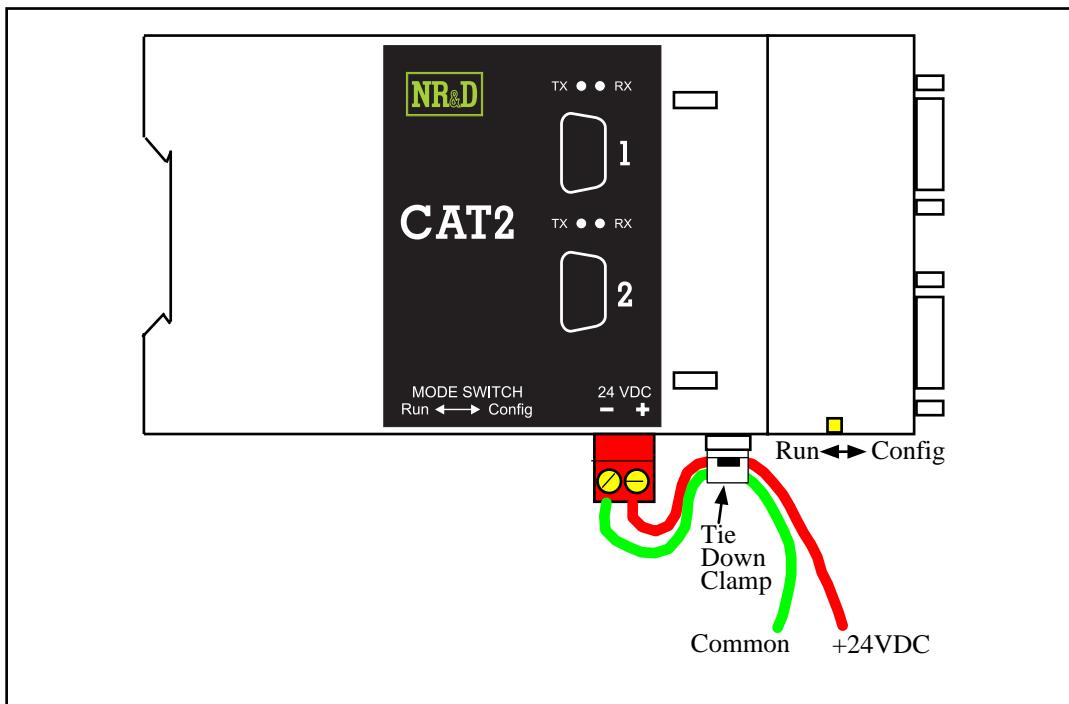
Figure 2-4   Power Supply Connection

CAT2 Configuration

1   Connect the personal computer to the CAT2 using an RS-232 cross-over cable connection. A standard Modicon programming cable may be used for this purpose. See page 43 for a cable pinout.
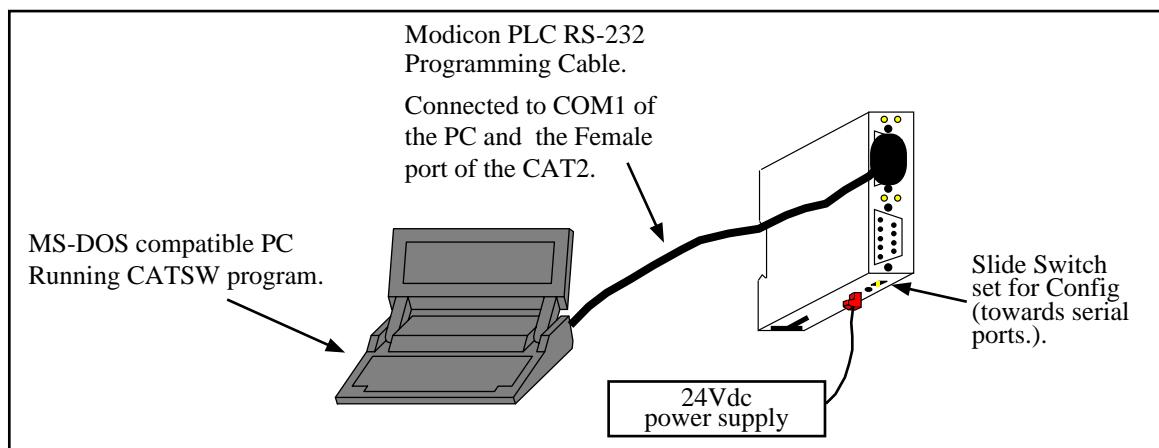
Figure 2-5   CAT2 Initial Configuration Setup

2   With the 24V power connected, slide the RUN/CONFIG switch to CONFIG.

3   Start CATSW on the personal computer.

4   Press N for oNline. The CATSW will attempt to communicate to the CAT2 and display the parameters of the module. The yellow TX and RX lights above the female serial port should be flashing quickly. If the setup parameters are correct, the screen should appear as in Figure 2-6.

   If an error occurs in communicating with the CAT2, an error window will open in the lower right corner. F10 will clear the error. Check the COM port setting, route setting, and your cabling. For a direct connection as in Figure 2-5, the default settings should work. For more information about the setup parameters of CATSW see page 33.

5   The arrow keys are used to maneuver from cell to cell. The gray +, and - keys and space bar are used to toggle through the available values for each cell.

6   Move the cursor to the upper left hand area to set the Port 1, RNIM Drop number. This number will be the RNIM Slave address for the CAT2 and must also match the Modbus Slave address of the attached Modbus device. This number must be unique for each RNIM Slave on the multidrop network.

7   Move the cursor down to set the baud rate of Port 1. This should be set to match the baud rate of the modem. All modems, RNIM Slaves, and the RNIM Master will have the same baud rate.

8   Move the cursor down to set the parity for Port 1. This will be set to match the modem and the RNIM Master.

9   Move the cursor down to set the Network ID. All RNIM devices on the multidrop network must have the same Network ID.

10   Move the cursor down to set the CTS Timer. This value sets the minimum time that the CAT2 will wait for CTS from the modem before transmitting. The value is in 10mS units. A value of 10 gives 100mS (0.1 seconds) of delay from the assertion of RTS before CTS is checked.

11   Move the cursor over and up to the baud rate of Port 2. Set this baud rate to match the attached Modbus Slave device.

12   Move the cursor down to the parity for Port 2. Set this value to match the attached Modbus Slave device.

13   Move the cursor down to the Timeout setting. This value sets the maximum amount of time that the CAT2 will wait for a reply from the Modbus Slave before the RNIM Slave port gives up and waits for a new message from the RNIM Master. This value should be set to the same amount of time (or slightly shorter) as the Reply Timeout of the RNIM Master. This value is set in 10mS units so a value of 1000 gives 10 seconds.

   NOTE: Some Modbus programming messages may take up to 10 seconds to send a reply.

14   If it is desirable to implement the Read/Modify/Write option for incoming SY/MAX non-priority bit-masked writes, set the RMW Trans to YES.

15   If operation with any of the POWERLOGIC SMS softwares needs to be supported, it may be desirable to set the SMS Spoofing option to YES.   If this option is set to yes and the "Spoof 8188" option is set to NO then an incoming read of register 8188 from SMS will be translated to a Modbus opcode 17 ID check. If the option is set to NO, then a read of 8188 will be translated to a Modbus read of Holding register 8188.

16   If the SMS Spoofing options is set to YES and the attached Modbus Slave doesn't support opcode 17, select "Spoof 8188" to YES and set the "8188 =" value to the Holding Register that is to be read instead of 8188. For example, a value of "8188 = 1" will yield a read of Holding register 1.

17   After completing the configuration, press ESCape to return to the main menu.

18   **With the CAT2 still powered,** slide the RUN/CONFIG switch back to RUN. The unit is now ready for field installation.

```
                    Compact Asynchronous Translator                    -
Niobrara R&D              CAT2 29JAN98                          09Feb98
                    Configuration and Utility Software

                    Port 1          Port 2
         Drop       1
     Protocol       RNIM SLAVE      MODBUS MASTER
    Baud rate       9600            9600
       Parity       EVEN            EVEN
   Network Id       0
   CTS Timer        10              1000
                                    No
                                    No
                                    No
                                    1
```
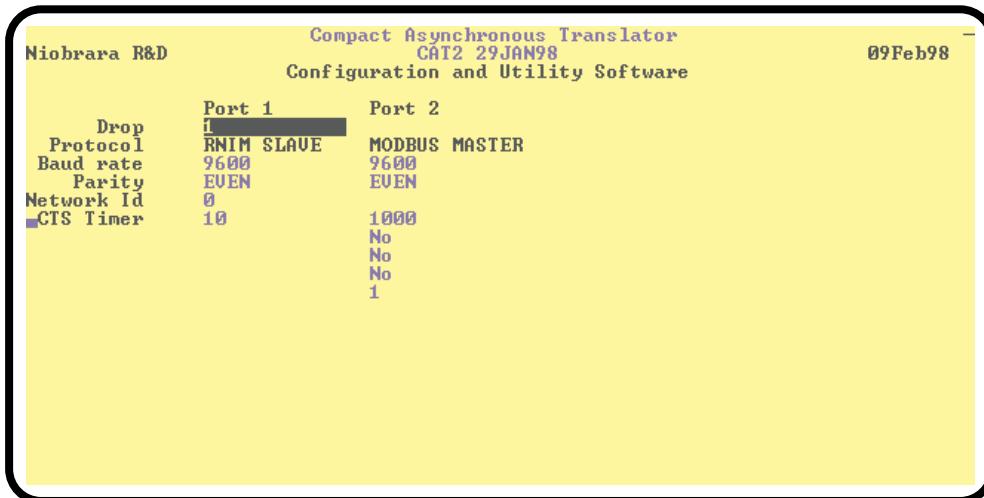
Figure 2-6   oNline Edit Screen

Modbus Slave Connection

Connect Port 2 of the CAT2 to the Modbus Slave. A "programming" cable may typically be used for this connection since the CAT2 has the same pinout as a personal computer. See page 41 for more information.

Modem Connection

Connect Port 1 of the CAT2 to the RS-232 port of the modem. See page 44 for more information.

3
Configuration

Each port of the CAT2 is independently configured for the baud rate, and parity. The protocol modes are fixed with Port 1 in RNIM Slave and Port 2 in Modbus RTU (Gate).

Modification of the configuration registers may be accomplished by writing to them with any device capable of generating SY/MAX write messages but is most conveniently accomplished with the MS/DOS compatible program CATSW provided with the module at no cost. CATSW must be used through Port 1 of the CAT2 with the RUN/CONFIG switch in CONFIG position.

The configuration registers are maintained in a nonvolatile EEPROM when the RUN/CONFIG switch is moved back to RUN

NOTE: After configuration, the RUN/CONFIG switch must be moved to RUN while the CAT2 is powered. If the switch is moved after the CAT2 is powered down, changes in the configuration will be lost.

Normal Operation Configuration

Each port must have certain parameters configured for proper operation. These parameters include:

- **Drop Number** - The drop number is the RNIM Slave (and Modbus) address for the CAT2. The drop number must fall within the range of 1 through 99 inclusive. The default value is 1.

- **Baud Rate** - The Baud Rate setting must be made to match the peripheral device. Possible values for Port 1 are 50, 75, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600, 14400, and 19200. Port 2 supports 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600, 14400, and 19200 baud. The default setting for both ports is 9600 baud.

- **Parity** - The Parity setting must match the attached modem and Modbus Slave peripheral. Possible settings are EVEN and NONE. The factory default value is EVEN.

- **Data Bits** - The Data Bits setting is fixed at 8 for both ports.

- **Stop Bits** - The Stop Bits setting is fixed at 1 bit.

- **Timeout** - The CAT2 Timeout value determines how long the unit will wait for a reply from the Modbus Slave before it gives up on an RNIM command. If a reply is returned from the Modbus Slave after this timeout expires, it will not be sent onto the RNIM network.

- **RNIM CTS Timer** - The CTS delay determines the minimum amount of time the CAT2 will wait for CTS to be raised after RTS is asserted. This value is set in 10mS units.

Several Options may be set for the Modbus port of the CAT2. Including POWERLOGIC Software Support options and SY/MAX non-priority Read/Modify/Write support.

PowerLogic Software use with Modbus Devices

Register 8188

The entire suite of POWERLOGIC software packages includes the "feature" that they use a Read of register 8188 to determine if a device is online. Unfortunately, not all Modbus devices have registers that extend to 8188 and an error will be returned on the translation. If it is possible, Niobrara recommends that the user assign 8192 registers to the address space to be read in the target device. Otherwise, Bit 9 of the Options register for the port may be set to enable the Modbus port to recognize the single read of register 8188 and translate that read into the Modbus opcode 17 (11hex) to determine the PLC ID of the Modbus Device. This option may be set from the oNline screen of CATSW by setting the "Spoofing" option to YES for Port 2.

The Modbus PLC ID message returns a one byte ID, a run/halt byte, and a variety of other information about the PLC. The Modbus Host port will return the PLC ID in the LSB of the R[8188] reply. Bit 15 of R[8188] will always be set in this reply. Bit 16 of R[8188] will indicate the run/halt state of the PLC; if set, the PLC is in run and if clear, the PLC is in halt. Table 3-1 displays the currently used PLC IDs from Modicon.

Table 3-1   Modicon PLC ID Values

ID Value	PLC Type
0	Micro 84
1	484
2	184/384
3	584
8	884
9	984/Quantum

For example, if a Modicon 984 is attached to a Modbus Host port with Bit 9 of the Options register set, if the PLC is in run, a read of R[8188] will return the data C009 (hex) and if the PLC is in halt, the data 4009 (hex) will be returned.

Other Register Support

Modbus Slave devices that do not support opcode 17 may be connected to the CAT2 by setting the "Spoofing" to YES and the "Spoof 8188" also to YES. When the Spoof 8188 is set to yes, the value in "8188 = " shows the Holding register in the Slave that a read of register 8188 will be translated to.

4

RNIM Slave Implementation

The RNIM Slave port (Port 1) provides compatibility with the Square D CRM-560 RNIM, the NR&D EPE5, SPE4, or MEB in RNIM Master mode. The RNIM protocol provides remote network access to SY/MAX devices using a half-duplex connection via radio/microwave/fiber optic/telephone links with the addition of a modem device.

The RNIM mode makes use of the RTS/CTS handshake lines in Push-to-Talk mode.

The RNIM protocol provides for a single Master device to communicate with up to 99 Slave devices. Communication may occur through any of four mechanisms:

- Direct Master originated to Slave (NORMAL operation)

- Slave originated to Master (BID operation)

- Slave to Slave command relaying (STORE/FORWARD operation)

- Master originated broadcasting (BROADCAST operation)

Full SY/MAX message support, including all types of READs, WRITEs, and Programming is provided over the RNIM link.

> **NOTE:** The CAT2 only supports "NORMAL" operation. BID, STORE/FORWARD, and BROADCAST operations are not supported.

NORMAL RNIM Operation

In general communication occurs by way of devices on the Master's local network sending messages routed to devices on a Slave's local network. The Master is usually located in a base station or control room and the Slaves are at the remote sites.

Under NORMAL operation, messages from the network of the Master are routed to a device on the network of a Slave. The SY/MAX route from the originator determines the exact path to the target device. In Figure 4-1, the Master RNIM is the CRM-560 and the SPE4 and both CAT2 units are acting as Slave devices. If a PLC on the "Blue Hose" at NIM address 134 needs to read a register in the Model 400 connected to the SPE4, a route of 134, 36, 24, 27 would be used. The Compact 984 may be reached with the route 134, 36, 22 and the Quantum via 134, 36, 19.
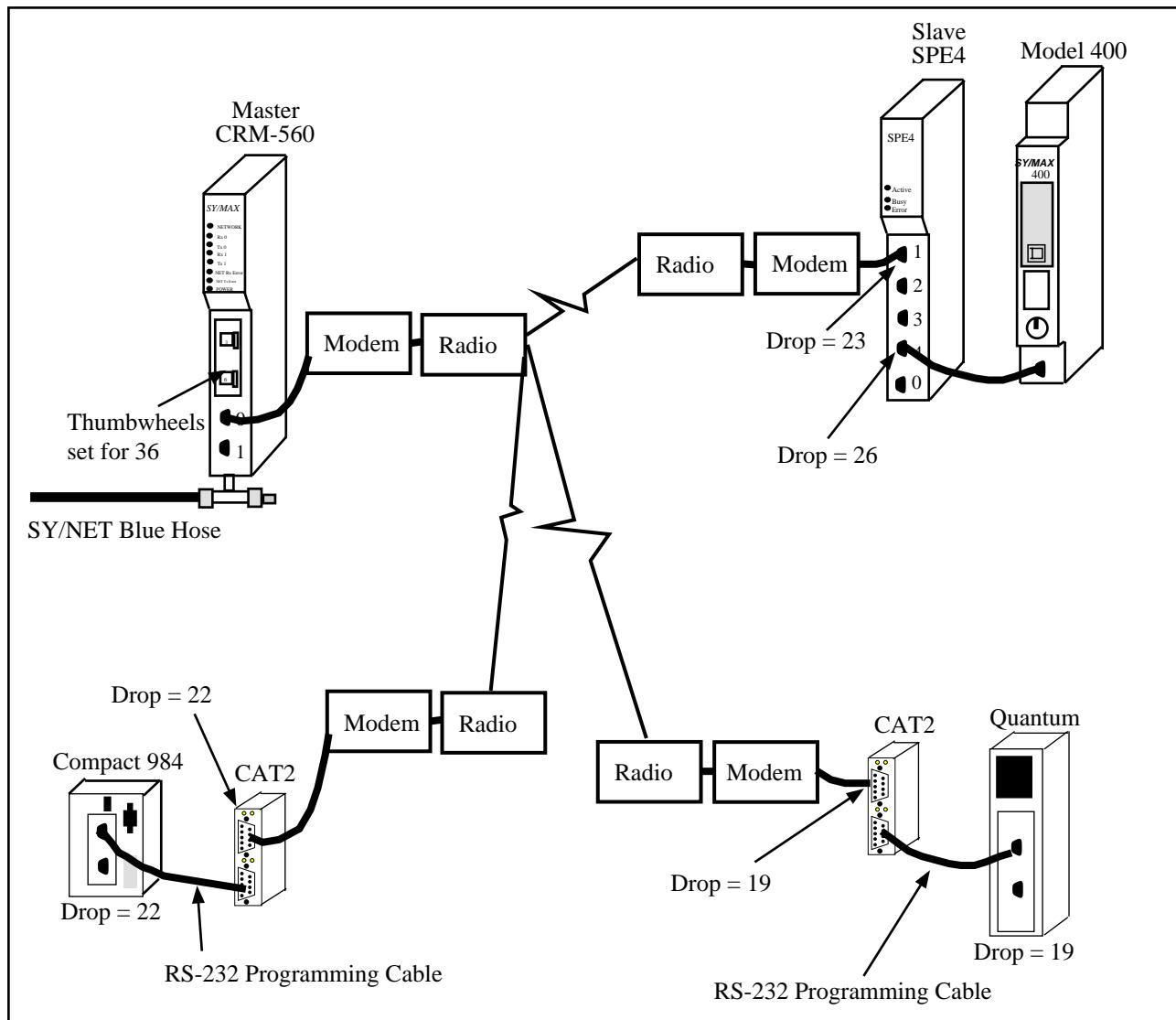
Figure 4-1   RNIM Example

The RNIM protocol is a single-threaded half-duplex system. Single-threaded refers to the fact that only one message may be outstanding at any given time. Half-duplex refers to the fact that the transmission media only supports communication in one direction at a time. When a message arrives at the Master, it places that message in a buffer until the current message on the remote network is completed. Once the current message is complete, the new message is sent.

5
MODBUS Mode

The Modbus protocol is implemented in a wide variety of products including Modicon PLCs, temperature controllers, flowmeters, intelligent valve systems, etc. The CAT2 provides a gateway translation from the SY/MAX protocol to/from Modbus RTU protocol. The CAT2 Modbus Gate mode provide reversible translations from SY/MAX messages to Modbus messages and vice versa using a defined series of rules.

Modbus Overview

The Modicon addressing scheme is somewhat different than SY/MAX. In the SY/MAX PLC there is only one memory address space for data. Input registers, output registers, discrete input bits, and discrete output bits are all treated as registers and bits within these registers. Because of this treatment of memory, the SY/MAX communications protocol requires only one type of message to read, and another to write data to and from external devices.[1]

The Modicon addressing method involves separate memory locations for input bits, output bits, input registers, and output registers. These different areas are denoted by the first character in the number that identifies the bit or register. Output bits (coils) are described by values in the range of 0xxxxx. Input bits (coils) are described by values in the range 1xxxxx. Input registers have values 3xxxxx and Output registers have values of 4xxxxx. Consequently the Modbus protocol requires separate messages to access the data in each of these areas. See Table 5-1.

For example, the first output bit in a Modicon PLC is addressed as 00001. The 150th output bit in the PLC is 00150 and is accessed using Function code 1 and written with Function codes 5 and 15. The seventeenth input bit is 10017 and is read by Function code 2. The 2381st input register is addressed by 32381 and is read with Function code 4. And the 52nd holding register is 40052 and read by Function code 3 and written with Function codes 6 and 16.

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[1] The SY/MAX protocol includes both Priority and Non-priority READ and WRITE messages, but the different messages still operate on the same memory address space.

Table 5-1   MODBUS Function Code List

Function Code	Description	MODBUS Address Range
01	Read Coil Status	0XXXXX
02	Read Input Status	1XXXXX
03	Read Holding Register	4XXXXX
04	Read Input Registers	3XXXXX
05	Force Single Coil	0XXXXX
06	Preset Single Register	4XXXXX
15	Force Multiple Coils	0XXXXX
16	Preset Multiple Registers	4XXXXX

SY/MAX Message Addressing

The SY/MAX protocol supports a variety of operations for transferring data from device to device.

Table 5-2   SY/MAX Messages

Opcode (hex)	Description	Notes
20	Priority Read	Used by SY/MAX PLCs.
00	Non-Priority Read	
04	Non-Priority Random Access Read	
1e	Priority Write	Used by SY/MAX PLCs.
02	Non-Priority Write	
1e	Priority Alarm	Special version of Priority Write.
22	Priority Print ASCII	

In the SY/MAX family of processors, only the Priority messages listed above are supported. These are the messages sent when a TWRITE, TALARM, TREAD, or network TPRINT is issued.

The Non-Priority WRITE message has the provision for a bit mask. This means that specific bits may be written to the remote device in a register without modifying other masked bits within that register. The Priority WRITE statement available in the PLC has no provision for a bit mask.

Message Translations

When messages cross from SY/MAX to Modbus media or vice-versa with a Niobrara bridge product (SPE4, EPE5, MEB) they are either reversibly translated or encapsulated and sent transparently. Translatable messages may be sent by one brand of device and operate successfully on another. By means of Niobrara's other translations, Modbus messages translated to SY/MAX operations may also operate on IDEC, PLOGIC, PNIM, and RNIM devices. Untranslateable SY/MAX or Modbus messages should only be directed to a device of the same brand to avoid unpredictable results. SY/MAX, PLOGIC, PNIM, and IDEC serial ports will return an encapsulated error to encapsulated Modbus messages. Modbus Host and Modbus Gate serial ports will return an encapsulated error to encapsulated SY/MAX messages. Net-to-Net, RNIM, MULTIDROP, ETHERNET, SY/NET, and Modbus Plus ports forward all messages transparently.

SY/MAX to Modbus Translations

SY/MAX originated messages which can be reversibly translated are listed in Table 5-3.

Table 5-3   SY/MAX to Modbus Translations

SY/MAX Message	Modbus Message
Priority Read (0x20)	Read Holding Registers (3)
Non-Priority Read (0x00)	Read Holding Registers (3) Registers 1 ..8192 detranslated as Priority Read
Priority Write (0x1E)	Write Multiple Registers (16)
Non-Priority Write (0x02) with mask all zeroes	Write Multiple Registers (16) registers 1..8192 detranslate as Priority Write
Non-Priority Write (0x02) with mask all zeroes	Force Multiple Coils (15) with bit and byte counts = 0
Non-Priority Write (0x02) with mask containing < 16 contiguous ones, count = 1, and register < 2048	Force Multiple Coils (15)
Non-Priority Write (0x02) with a mask a single one, register count = 1 and register < 2048	Force Single Coil (5)

All other SY/MAX commands will be encapsulated following Modbus opcode 17 (0x11) with a single parameter 0x01 and sent transparently over the Modbus media. Replies to encapsulated SY/MAX queries are encapsulated with opcode 17 and parameter 0x02. This opcode normally has no parameters, so the presence of parameters allows the router to determine that the message is an encapsulated SY/MAX command and not a valid Modbus opcode 17.

Modbus to SY/MAX Translations

Modbus originated messages which can be reversibly translated are as follows. Note that accessing registers 8193..16384 reads or writes that status portion of SY/MAX register 1..8182.

Modbus devices should preferably use opcodes 3 and 16 to access registers in SY/MAX devices because these queries translate with legal status register addresses. Other Modbus opcodes may be used but are not guaranteed to be accepted by all SY/MAX end nodes (i.e. PowerLink). All Niobrara SY/MAX ports will accept the SY/MAX translation of any translatable Modbus query. Table 5-4 lists the Modbus to SY/MAX translations.

Table 5-4   Modbus to SY/MAX Translations

Modbus Message	SY/MAX Message
Read Coil Status (1)	Priority Read (0x20) with status register address 0xMN03 where M is the start bit modulo 16 and N is the bit count modulo 16
Read Input Status (2)	Priority Read (0x20) with status register address 0xMN05 where M is the start bit modulo 16 and N is the bit count modulo 16
Read Holding Registers (3) register 1..8192	Priority Read (0x20) with status register address 0x0006
Read Holding Registers (3) register 8193..16384	Non-Priority Read (0x00) status field with Transnum 0x03
Read Input Registers (4) register 1..8192	Priority Read (0x00) with status register address 0x0009
Force Single Coil (5)	Non-Priority Write (0x02) with Transnum 0x05 and single bit set in mask
Preset Single Register (6) register 1..8192	Priority Write (0x1e) with status register address 0x00d
Preset Single Register (6) register 8193..16384	Non-Priority Write (0x02) status field with Transnum 0x06
Force Multiple Coils (15) if start coil on word boundary and bit count integral multiple of 16.	Priority Write (0x1e) with status register address 0x001f
Force Multiple Coils (15) if all coils lie in one register and count < 16. Force multiple coils with coil count = 1 may be detranslated as force single coil.	Non-Priority Write (0x02) with Transnum 0x0f and appropriate (not 0xfff) mask
Write Multiple Registers (16) register 1..8192	Priority Write (0x1e) with status register address 0x0020
Write Multiple Registers (16) register 8193..16384	Non-Priority Write (0x02) with Status field with Transnum 0x10

All other Modbus messages will be encapsulated for transmission of SY/MAX media in a Print command (0x22) with status register address 0xBAD5. This normally illegal status register value enables downstream translations to distinguish the encapsulated messages from an actual SY/MAX print message (which must be encapsulated to ride Modbus media). Replies to untranslatable Modbus messages are encapsulated as the Print Reply (0x92) with the same, illegal, status register address. Encapsulated Modbus query and response packets include a byte for the Modbus address following the status register address bytes. This byte is unused but is required for compatibility with existing Niobrara Modbus to SY/MAX translations. Niobrara translator conforming to this specification set this unused byte to zero on transmission and ignore it on reception.

Master Operation

The Modbus Gate mode may be used to connect Modbus slaves and networks of slaves to SY/NET. The Modbus Gate mode uses the translations in Table 5-3 to convert SY/MAX messages to Modbus serial messages.

Register Calculations

The Modbus commands which are register operations, (3, 4, 6, 16) are related to the SY/MAX REMOTE address specified in the READ or WRITE by the following formula:

MODBUS address = SY/MAX REMOTE address

> Example: A SY/MAX read is routed to a Modbus port of an CAT2. The CAT2 will translate the incoming SY/MAX read to a Holding Register read with Opcode 3 The

Modbus Address to be read is 400121. The SY/MAX remote address for the READ is also therefore 121.

6

Configuration Software CATSW

CATSW

The CATSW software program is provided free of charge to CAT2 users. This software is used to configure the operational parameters of the CAT2. CATSW can be operated in either online or offline modes.

In oNline mode, CATSW presents the user with a screen of data describing the operation all of the module's ports. The arrow keys are used select the port parameters to be modified and the space bar and + and - keys are used to change the parameters of that port. Changes made in the online mode are transferred to a connected CAT2 module and are effective immediately, but are not saved in EEPROM until the CONFIG switch is moved to RUN while the unit is powered.

In offline mode, CATSW allows a copy of the configuration to be uploaded from the CAT2 to an image in offline memory. The offline copy can be edited without affecting the CAT2 in real time. The offline copy can be saved to a named disk file for later retrieval, or listed on a hard copy printer. A CAT2 need not be connected to perform most offline operations. The offline copy of the configuration parameters may be downloaded to a CAT2 module at any time.

The startup screen of CATSW is shown in Figure 6-1 on page 26. The operational modes are selected by the highlighted menu bar on the fourth line. Selection can be made by moving the cursor to the desired option using the arrow keys and pressing **ENTER**. A short cut is provided, simply type "**N**" for online, "**F**" for offline, "**U**" for Utility, "**S**" for setup or "**Q**" to quit.
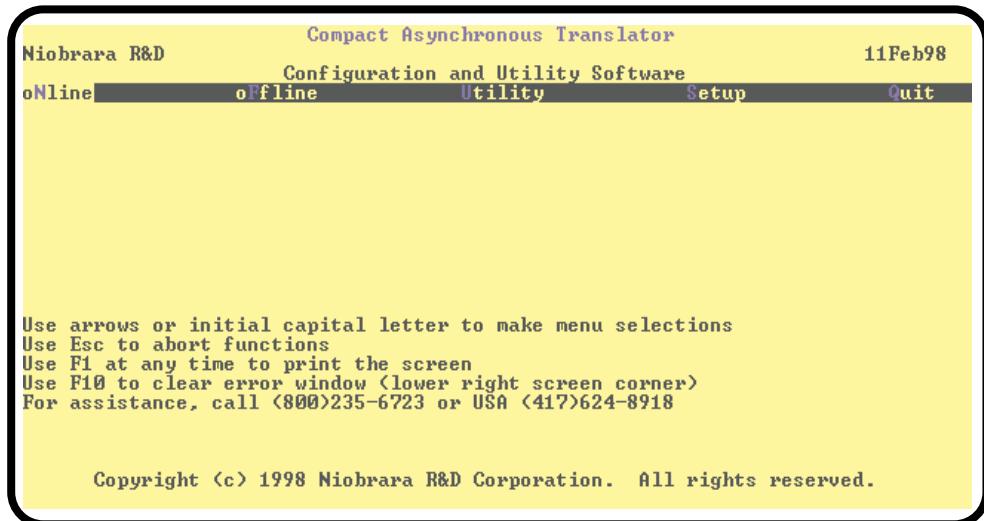
Figure 6-1   CATSW Startup Screen

If offline mode is selected, a second menu appears as shown in Figure 6-2 on page 26. This menu presents the available functions for manipulating the offline image of the configuration parameters and for transfer of configuration data to and from the CAT2 module. Use the up and down arrows to move the highlight, **ENTER** to select the highlighted choice, or the initial capital letter to quickly select an option.

The online and offline parameter editing screens are nearly identical. The difference is in operation. Every time a change is made in the online mode, the modified parameter is transmitted to the CAT2. In offline mode, changes are made to the parameter image in offline memory. Changes made in the online screen affect only the configuration stored in the attached CAT2, not the offline copy. Likewise, changes made in offline mode have no effect on a connected CAT2 until they are explicitly sent to it using the "Send memory to CAT2" function.

CATSW also contains several convenient utilities for general use, a SY/MAX Register Viewer and a Terminal Emulator. The Register Viewer uses the same setup as the oNline and oFfline functions. The Terminal Emulator has its own setup characteristics.
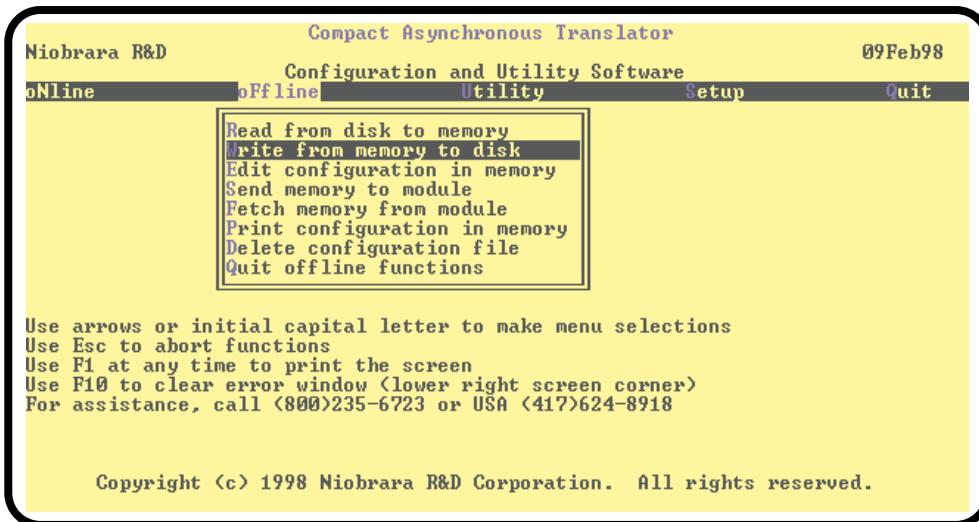
Figure 6-2   CATSW oFfline Menu

Data Entry Keys

Whenever data entry is allowed by the program, certain keys can be used to facilitate data entry. They are:

BACKSPACE	Move cursor left and remove character there
LEFT ARROW	Move cursor to the left one character
RIGHT ARROW	Move cursor to the right one character
DEL	Remove the character under the cursor
INS	Change between insert and overstrike modes of entry
HOME	Move cursor to the left edge of the field
END	Move cursor to the end of the data
Control-F	Move cursor right (Forward) one word
Control-R	Move cursor left (Reverse) one word
Control-D	Delete from the cursor to the end of the field
Control-U	Delete from cursor to the beginning of the field
Control-Y	Delete all characters in the field
ESC	Exit the field without modifying it
ENTER	Accept the contents of the field

When a field is opened for input, the cursor is positioned at the left side of the field. If data is already present in the field, typing any character other than those listed above will cause the field to be blanked allowing entry of new data without first deleting the old. If it is desired to retain the previous data for editing, make sure the first key you type is an editing key such as a left or right arrow.

Most data fields in CATSW do not allow direct entry of the parameter, instead a series of choices is presented. The following keys are used:

GRAY +	Increments options to the next available choice
GRAY -	Decrements options to the previous choice
SPACE BAR	Increments options and rolls back to first option after last

The arrow keys are used to maneuver between fields.

Online and Offline Editing Screen

In either the online or offline mode, parameters are changed by moving the highlighted cursor to the desired field using the arrow keys and by pressing the +, -, or space bar to toggle through available parameters.
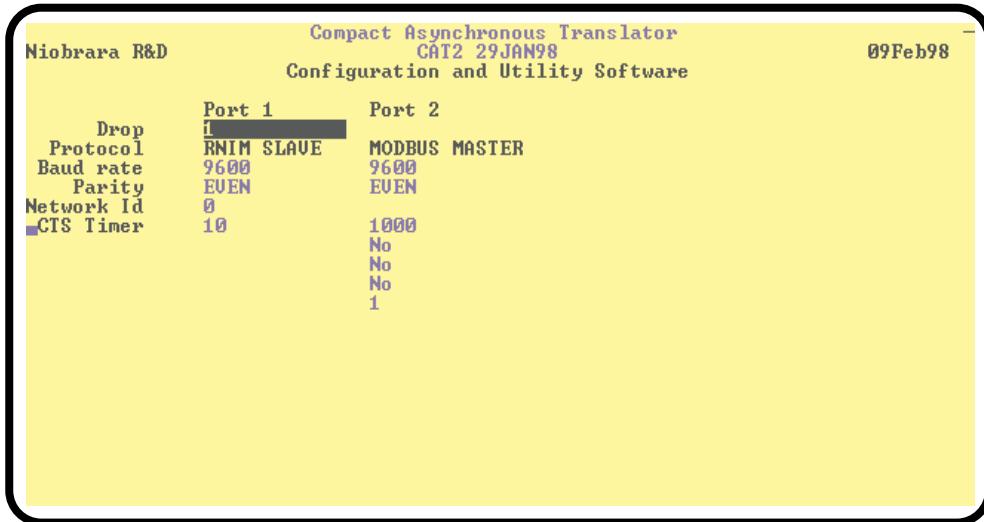
Figure 6-3   CATSW oNline Edit Screen

The oNline Edit (and oFfline Edit) screen is presented as a matrix of parameters, see Figure 6-3. Each column represents one of the ports of the CAT2. The lower half of the screen will change to present the available parameters for each protocol mode. The parameters are described below.

Drop Number

(Port 1) This value determines the RNIM drop number of the CAT2. The drop number must fall within the range of 00 through 99. The default drop number is 1

Protocol

Port 1 is fixed at RNIM Slave while Port 2 is fixed at Modbus RTU (Gate). These protocols may not be altered.

Baud Rate

(Ports 1,2) Controls the baud rate of the individual port. This value should be set to match the baud rate of the device attached to the port. The default value is 9600.

Parity

(Ports 1,2) Controls the parity of the individual port and should be set to match the attached device. Available choices are EVEN and NONE. The default value is EVEN.

Data Bits

(Ports 1,2) Fixed at 8 bits and may not be altered.

Stop Bits

(Ports 1,2) Fixed at 1 bit and may not be altered.

Network Id

(Port 1) This number must be the same for all RNIM devices on the same Remote Network. The Network Id allows multiple Remote Networks to operate within close range on the same frequency. RNIM devices only respond to messages that match their own Network Id. The Valid data range is 0 through 255 with the default value of 0.

NOTE: The Square D CRM-560 always defaults to a Network Id of 0 upon power-up.

CTS Timer

(Port 1) The CTS timer provides a minimum amount of time to wait for the Clear to Send hardware handshake line to become active after the Request to Send (RTS) line has been asserted. The unit of time is 10mS. A value of 50 provides a 500mS delay. The valid data range is 0 through 65535 (655.35 seconds max).

NOTE: The Square D CRM-560 CTS timer has units of 50mS and defaults to a value of 10 (for a delay of 500mS) upon power-up.

Timeout

(Port 2) This value sets the message response timeout in 10mS units. This value determines the amount of time that the RNIM port will wait for a response from the Modbus port before refusing to transmit a reply The valid data range is 0 through 65535 (0 sec to 655.35 sec) with a default value of 1000 (10 seconds) This value should be the same as the timeout value of the RNIM Master.

NOTE: The Square D CRM-560 Message response timeout is in 1 second units and defaults to 20 seconds upon power-up.

HOTKEYS

F1 Print Screen hotkey

Pressing the F1 key at any time will allow for printing of the screen to a printer or text file. Pressing the F1 key will produce a window similar to Figure 6-4.
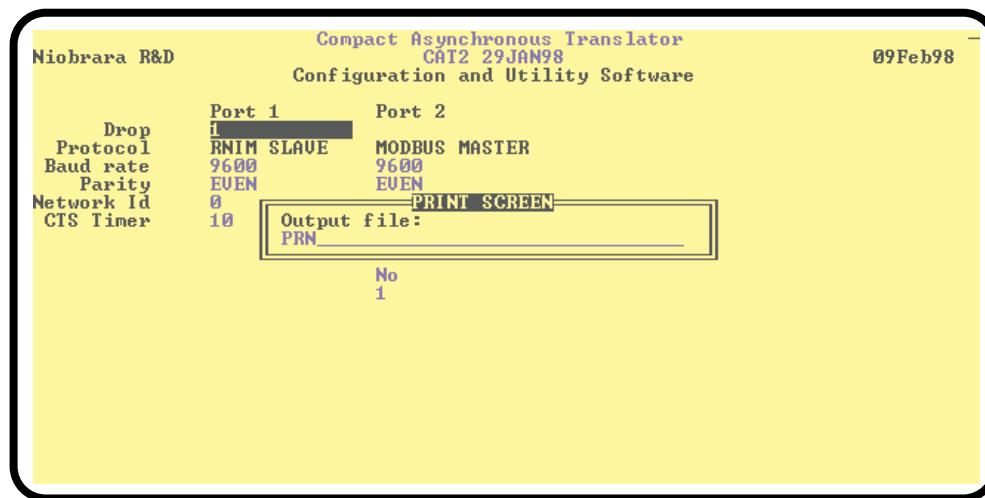
Figure 6-4   F1 Print Screen

The new window prompts for an output filename. The default is PRN which prints to the DOS default printer. If a valid DOS filename is typed into the field, CATSW will print the information to that filename as an ASCII text file.

F2 Help Window

Pressing the F2 key will present the help window shown in Figure 6-5. Pressing any key will return to the previous location


```
                    Compact Asynchronous Translator
Niobrara R&D                  CAT2 29JAN98                        09Feb98
                     Configuration and Utility Software

                    Port 1           Port 2
         Drop       1              ┌──────────PARAMETER EDITOR HELP─────────┐
     Protocol       RNIM SLAVE     │ Beware of changing the port you are connected
    Baud rate       9600           │ to which is displayed at top center of screen.
       Parity       EVEN           │ Use Up and Down arrows, Page Up, and Page Down
   Network Id       0              │ to select a field.
    CTS Timer       10             │ Use Left and Right arrows, Home, and End to
                                   │ select a port.
                                   │
                                   │ In multiple choice fields, + key increases, −
                                   │ decreases, and spacebar increases to the last
                                   │ choice and then wraps to the first choice.
                                   │ In numeric fields, type new value and ENTER.
                                   │
                                   │ Type ESC to exit online parameter editor.
                                   │ Type F10 to clear error window.
                                   │ Type F3 for real time statistics.
                                   │ Type F9 to change Sy/Max communication setup.
                                   │
                                   │ Press any key to close help window.
                                   └────────────────────────────────────────┘
```

Figure 6-5   F2 Help Window

Offline Functions

"Read from disk to memory"

This function reads an CAT2 configuration file into the offline memory. The file should have been created by the "Write from memory to disk" function described below and must have a .CAT extension. When "Read from disk to memory" is selected, a window will open and ask for the name of the file to read. The bottom part of the screen will show a list of all files with the extension .CAT in the current directory. Any subdirectories will be shown in square brackets. Any drive names will also be shown in square brackets, [b:]. The parent directory (of which the current directory is a subdirectory) is shown by the word "parent" in square brackets. You may either type the name of the file to read or you may use the arrow keys to move the highlight to the desired filename. Pressing **ENTER** with the highlight on a filename will select that file for reading. Pressing **ENTER** with the highlight positioned on a directory (drive) name (either a subdirectory or [parent]) will change the current directory (drive) to that directory (drive) and will show the .CAT files in the new directory (drive). If there are more files than will fit on the screen, pressing the right arrow with the highlight at the right edge of the screen will scroll the display sideways to show more files. Typing the **ESC** key will return to the offline function menu without loading a file or otherwise modifying offline memory.

"Write from memory to disk"

This function saves a copy of the four ports and global configuration parameters from the offline memory to a disk file. "Write from memory to disk" uses the same point and shoot file selection described for "Read from disk to memory" above. To create a new file you must type the name. The name should be a valid MS/DOS filename but should not include any path name or extension. The program will append an extension of .CAT to the name and the file will be placed in the directory which is shown in the bottom half of the screen. To create a file in a directory other than the current one, use the arrow and **ENTER** keys to traverse the directory tree until a listing of the desired directory is shown in the bottom half of the screen. Then type in the file name and press **ENTER**. If you specify (either by typing or by pointing) a file that already exists, you will be prompted for approval before that file is overwritten.
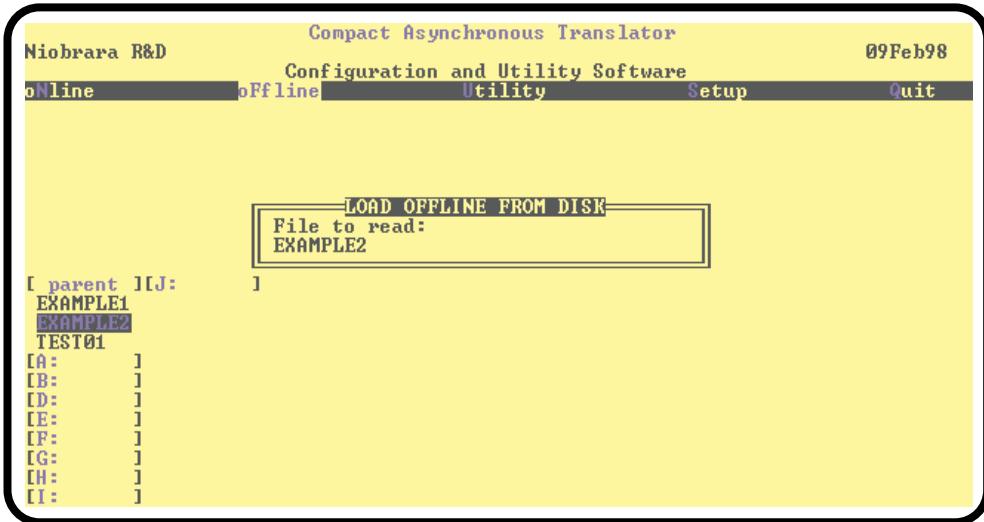
Figure 6-6   oFfline Read from Disk to Memory

"Edit configuration in memory"

Just like the online portion of the program, this function displays a screen with the parameters for a single port. As described above, changes here effect the offline memory and not any attached CAT2.

"Send memory to module"

This function will send the configuration in memory to the CAT2 module by way of the SY/MAX setup parameters. In order to send the configuration to the CAT2 it is necessary for the personal computer to communicate with the CAT2. Try going oNline before sending a configuration.

Be cautious when sending a configuration. Go oNline and notice which port the connection is being made to the module. Examine the configuration before sending to make sure that the port connecting to the personal computer will not change from the current settings, otherwise communication may be lost during the send.

"Fetch memory from module"

Use this function when you wish to copy the configuration parameters from a connected CAT2 module to the offline memory for editing, printout, or saving on disk. "Send memory to the CAT2"

This function transfers all five ports' configuration parameters from offline memory to the CAT2. This function can be used to load configuration back into the CAT2 after it has been Fetched and Edited or if it has been read from a previously saved disk file.

"Print configuration in memory"

This function will produce a report showing the settings of all parameters in offline memory. When this function is selected, you will be prompted for an output filename with the default value of PRN shown. To send the report to the PRN device (normally the parallel printer port), simply press **ENTER**. To send the report to a different port or to a file, type the name and then press **ENTER**. Online configurations may be printed with the **F1** print screen key.

"Delete configuration file"

This function will show a point and shoot menu of the available CAT2 configuration files. Select the file to be deleted and press ENTER.

"Quit offline functions"

Selecting the quit item will cause a return to the main menu bar. Pressing the ESC key will have the same effect.

Utilities

The Utilities menu provides access to useful maintenance and testing functions of the CATSW software.

View registers

Selecting the View registers menu item will invoke a SY/MAX register data viewer/modifier. This viewer continuously performs a block read of 20 registers and displays the contents of those registers in hex, unsigned integer, signed integer, and binary. The status register associated with the data register is also displayed in hex. Like any other oNline or oFfline function involving communication, the register viewer is dependent on the values located in the SETUP Sy/Max menu. Mode, Baud rate, Parity, Route, etc. must be properly set for proper communication.

```
                    Compact Asynchronous Translator
Niobrara R&D          CAT2 29JAN98 Port 0                    09Feb98
                  Configuration and Utility Software
REGSTR   HEX   UNSIGN  SIGNED          BINARY            STAT
 8035    0001      1       1    0000 0000 0000 0001      0001
 8036    000D     13      13    0000 0000 0000 1101      000D       NR&D Sy/Max
 8037    0000      0       0    0000 0000 0000 0000      0000      Register Viewer
 8038    0002      2       2    0000 0000 0000 0010      0002
 8039    0000      0       0    0000 0000 0000 0000      0000     Press F2 for Help
 8040    000D     13      13    0000 0000 0000 1101      000D
 8041    0000      0       0    0000 0000 0000 0000      0000
 8042    000A     10      10    0000 0000 0000 1010      000A
 8043    0000      0       0    0000 0000 0000 0000      0000
 8044    0000      0       0    0000 0000 0000 0000      0000
 8045    0000      0       0    0000 0000 0000 0000      0000
 8046    0000      0       0    0000 0000 0000 0000      0000
 8047    0000      0       0    0000 0000 0000 0000      0000
 8048    0000      0       0    0000 0000 0000 0000      0000
 8049    0000      0       0    0000 0000 0000 0000      0000
 8050    0000      0       0    0000 0000 0000 0000      0000
 8051    0000      0       0    0000 0000 0000 0000      0000
 8052    0000      0       0    0000 0000 0000 0000      0000
 8053    0000      0       0    0000 0000 0000 0000      0000
 8054    0000      0       0    0000 0000 0000 0000      0000
```

Figure 6-7   View Registers

The Up and Down arrow keys are used to move from register to register.

The Page Up and Page Down keys move in increments of 10 registers.

The Left and Right arrows move from column to column on the same register.

Pressing the F9 key will present the SY/MAX setup window. This is useful for changing the route or other parameters without returning to the main menu.

This register viewer is highly useful in that it allows easy editing of the data in the register being viewed. By pressing 0..9 in the decimal fields or 0..9, or A..F in the hex field, an editing mode is entered. New data may be entered at this time. Pressing the Enter key or moving to a new field with the arrow keys will cause the new data to be written to the edited register. If the curser is located in the REGISTER column the block of registers being viewed may be adjusted by entering a new register number. To edit the binary values, press HOME when on the binary field. Move the cursor to the desired bit and enter a '0' or a '1' and press enter to accept.

Pressing Esc will exit from the Register viewer and return to the main menu. Pressing Esc while editing a data field will result in canceling the edit and the modified data will not be written to the register.

The STAT field displays the status register associated with the data register. The STATUS field is a read only display and can not be modified by the Register Viewer. Two common values are E000 and A000. A000 is the hex representation that the PLC recognizes as a PLC OUTPUT register. E000 is for a PLC INPUT register. This allows easy recognition of registers controlled by the CAT2 as inputs and used by the PLC as outputs.

Terminal Emulator

Selecting the Terminal emulator from the Utilities menu will invoke a terminal emulator according to the setup selected in the Setup menu. The terminal emulator opens as shown in Figure 6-8.
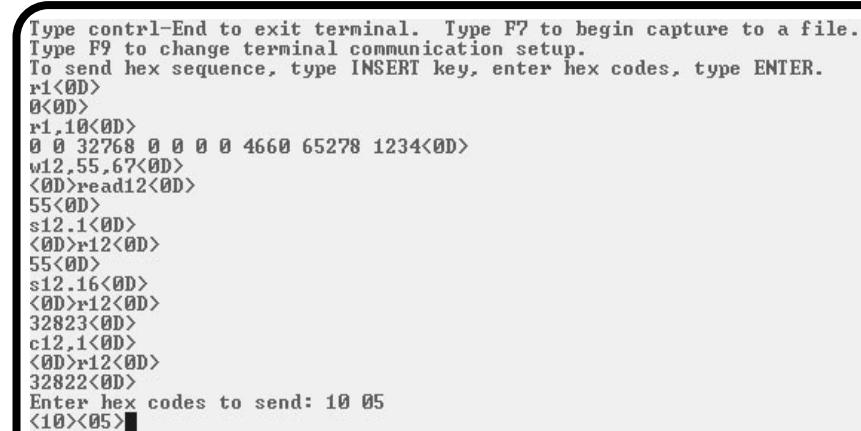
```
Type contrl-End to exit terminal.  Type F7 to begin capture to a file.
Type F9 to change terminal communication setup.
To send hex sequence, type INSERT key, enter hex codes, type ENTER.
r1<0D>
0<0D>
r1,10<0D>
0 0 32768 0 0 0 0 4660 65278 1234<0D>
w12,55,67<0D>
<0D>read12<0D>
55<0D>
s12.1<0D>
<0D>r12<0D>
55<0D>
s12.16<0D>
<0D>r12<0D>
32823<0D>
c12,1<0D>
<0D>r12<0D>
32822<0D>
Enter hex codes to send: 10 05
<10><05>█
```

Figure 6-8   Terminal Emulator

The terminal sends the ASCII code for the alpha-numeric characters out the selected COM port. Functions keys F1 through F4 and the keypad arrows send ANSI (i.e. VT100) codes. F7 is reserved for starting a file capture. F8 will close the capture file. The backspace key sends ASCII BS (08 hex). The Delete key sends and ASCII DEL (7F hex). The Insert key allows the transmission of ASCII hexadecimal characters directly from the hex numbers separated by spaces.

The terminal displays printable ASCII characters which are received on the port. Non-printable characters are displayed as the hexadecimal value enclosed in <>, such as <0D><0A> indicates the carriage return, line feed characters. The terminal is always in this "monitor" mode and therefore ANSI output emulation is not provided.

Pressing F9 will invoke the Terminal Emulator Setup window. This is useful for changing the port parameters without returning to the main menu.

SETUP

The setup menu accesses the setup parameters for the personal computer to enable it to communicate with the CAT2 and the terminal emulator. The parameters chosen will depend on the exact equipment involved in making the connections.

Setup Serial Port

Port - When one of the COM: connection types is selected a particular port of the personal computer must be selected. Available choices are: COM1:, COM2:, COM3:, and COM4:. Select the port which will be used to connect to the CAT2.
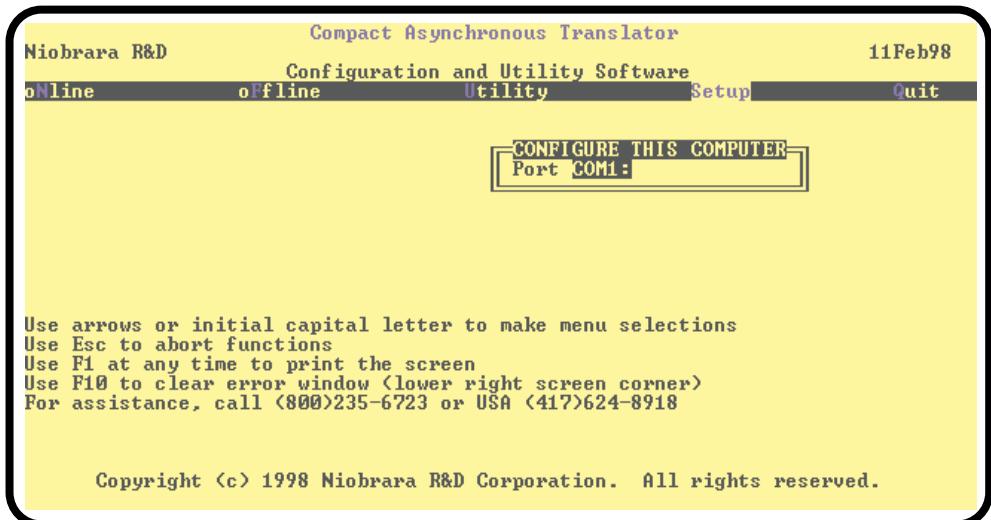
Figure 6-9   SY/MAX Setup Screen

Terminal Emulator SETUP

The Terminal Emulator setup allows an individual setup for the operation of the terminal emulator. For instance, this separate setup will allow COM1 to be used for the CAT2 SY/MAX connection and COM2 to be used for a terminal emulator connection.
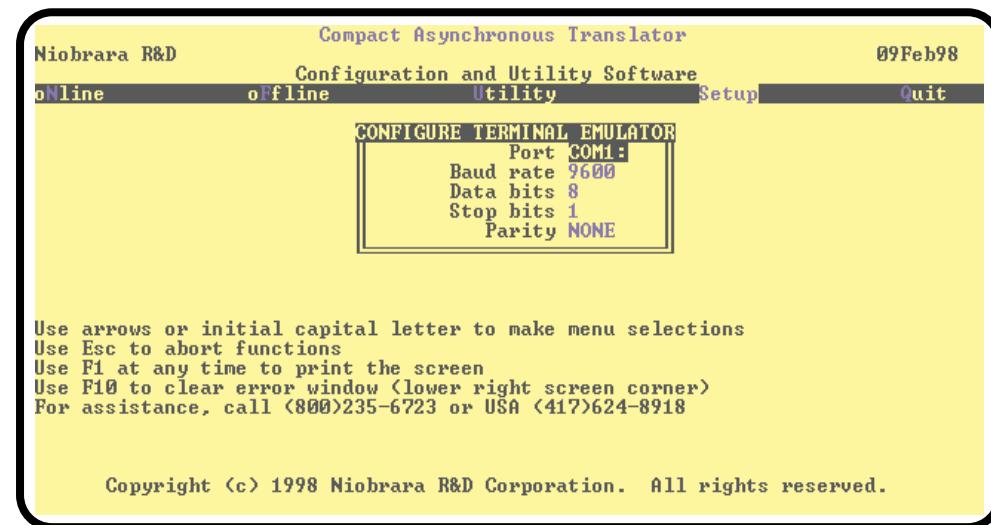
Figure 6-10 Terminal Emulator Setup Screen

Port - Available choices are: COM1:, COM2:, COM3:, and COM4:. Select the port which will be used to connect to the external device.

Baud rate - The Baud rate selected here is the baud rate of the personal computer serial port selected. This value should be set to match the device connected to the personal computer.

Data bits - Selects the number of data bits for the message packet. Choices are 8 or 7 depending on the attached device.

Stop bits - The stop bits are normally set to 1 but may be adjusted to 2 for some particular application.

Parity - Choices are EVEN, ODD, and NONE.

Register Viewer Setup

The Register Viewer Setup allows an individual setup for the operation of the Utility Register Viewer.
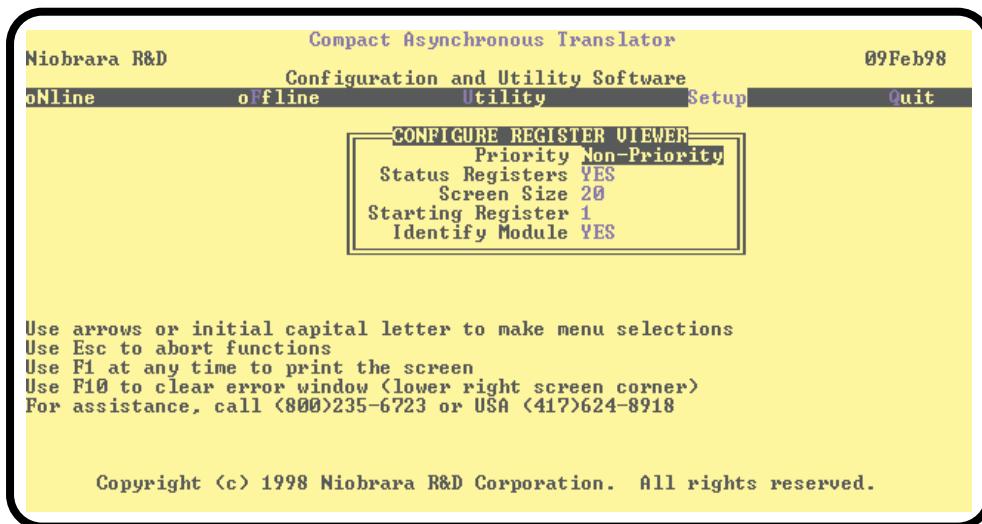
Figure 6-11 Register Viewer Setup Screen

Priority - The Priority setting allows the choice of Priority or Non-Priority SY/MAX messages for the read and write operations of the register viewer. The default is Non-Priority.

Status Registers - This setting allows the reading of the status bits (bits 17 through 32) of a SY/MAX register. If set to YES, the Priority setting must be NON-PRIORITY when the target is a SY/MAX PLC. The default setting is YES.

Screen Size - Selects the number registers to be read per operation and displayed on the screen. The valid range is 1 through 20 inclusive. The default value is 20.

Starting Register - The starting register value determines the first register polled when the register viewer is entered. The valid range is 1 through 8192 inclusive with the default value of 1.

Identify Module - This option determines if the register 8188 is read in the target device to determine the SY/MAX ID of the target. The default value is YES.

Load from File

The Load from File option allows the user to select from multiple SY/MAX setups. Simply enter the filename of the setup desired and CATSW will use that setup. CATSW always saves the current setup as CATSW.STP regardless if a new setup has been loaded.   The idea is that you configure the setup as you like, save it to CATSW.STP by selecting Y for yes when prompted, quit CATSW to DOS, and copy CATSW.STP to a new filename with the extension .STP. The following DOS command copies the CATSW.STP to a new name CAT01.STP:

> C:\CAT2> copy catsw.stp CAT01.stp

Command Line Parameters

CATSW may be started from the DOS command line with a sequence of letters which represent the keystrokes necessary to perform any operation. This allows batch processing of various commands such as downloading of stored setup files. The special characters /R, /D, and /E refer to the Return key, Delete key, and Escape key respectively. The parameters are not case sensitive.

7

Local Registers

The CAT2 configuration is controlled by writing to a set of processor equivalent registers local to the CAT2 module while the RUN/CONFIG switch is set to CONFIG. These registers may be read or written by sending SY/MAX read and write messages to the module itself through Port 1. The Register Viewer located in the Utility section of the CATSW program is a convenient interface to the module's registers.

Setup and Configuration Registers

Data Port Control Registers

Each of the Data Ports may have independent settings for Drop Number, Baud Rate, Parity, Data bits, Stop bits, Mode, Auto-transfer, etc. These are controlled by register values listed in Table 7-1.

Table 7-1   Port 1 Configuration Registers

Port 1	Legal Values	Default Values	Function
8035	1..99	1	RNIM Slave Drop Number
8036	0,1,4,5,6, 7,9,11,13,15	13	Baud Rate 13=9600 (See Table 7-3 on Page 38)
8038	0,2	2	Parity Bits 2 = EVEN, 0 = NONE
8041	0..255	0	RNIM Identification Number
8042	0..65535	0	RNIM Minimum CTS Delay (10mS units)

Table 7-2   Port 2 Configuration Registers

Port 2	Legal Values	Default Values	Function
8068	7,9,11,13,15	13	Baud Rate 13=9600 (See Table 7-3 on Page 38)
8070	0,2	2	Parity Bits 2 = EVEN, 0 = NONE
8074	0..32767	500	MODBUS reply timeout (10mS units) 500 = 5 seconds
8094	Bits 9, 10, 11	0	Options (See Table 7-5 on Page 38)
8095	0..127	1	Register to read if Option bits 9 and 10 are set in R[8094]

Table 7-3   Baud Rate Values

Baud Register	Baud Rate	Notes
0	50	Port 1 (RNIM) only
1	75	Port 1 (RNIM) only
2		Illegal, but sets 9600
3		Illegal, but sets 9600
4	150	Port 1 (RNIM) only
5	300	Both Ports
6	600	Both Ports
7	1200	Both Ports
8	1800	Both Ports
9	2400	Both Ports
10	3600	Both Ports
11	4800	Both Ports
12	7200	Both Ports
13	9600	Both Ports
14	14400	Both Ports
15	19200	Both Ports

Table 7-4   Parity Values

Parity Register	Parity
0	None
1	Illegal, but sets Even
2	Even

Table 7-5   Options Register Values

Option Bit	Function when Bit CLEAR (Default)	Function when Bit SET
9	Normal Modbus Host R[8188] reply.	SMS Register 8188 spoofing on Modbus Host.
10		If bit 10 and bit 9 are set, the value in R[options+1] is used as the remote register polled in SMS read of 8188.
11		Read/Modify/Write ON

NOTICE: Bits 9, 10, and 11 are the only active Options bits

Options

The Options Register allows the modification of the normal operation of several features of the CAT2.

- Bit 9 also is used on the Modbus port to provide spoofing of PowerLogic System software. All PowerLogic softwares send a SY/MAX read to register 8188 to determine if the device is online. Not all Modbus devices may be configured to have an address within this range. When this bit is set, the Modbus Host port intercepts a single register SY/MAX read of register 8188 and translates that message to a Modbus Report Slave ID (opcode 17 decimal) message. The Slave ID and the Run/Halt status of the Modbus device are returned as the data to the register 8188 read. The Slave ID byte is returned as the LSB of register 8188. Bit 14 of 8188 will always be set to indicate that this translation has occurred. And Bit 15 of 8188 will be set if the Modbus device is in RUN and clear if the device is in Halt.

- Bit 10 may be used in conjunction with bit 9 to have SMS poll non-PLC devices that don't support opcode 17. When bits 10 and 9 are both set, the value in R[options+1] is used as the remote register to poll in the Modbus Slave when a read of register 8188 is received on the port. For example, if bits 9 and 10 of register 8094 in the CAT2 are set, and register 8095 has the decimal value of 10, then Holding register 10 in the Modbus slave will be read when SMS performs its health check of register 8188.

- Bit 11 determines the Modbus translation for an incoming SY/MAX bit-masked non-priority write. If Bit 11 is set then the CAT2 does a READ/MODIFY/WRITE for the Holding Register in the Modbus Slave. If bit 11 is clear then the normal translation to an opcode 05 or 15 bit write occurs.

Module Identification Registers

All NR&D modules contain a group of registers, 8176..8188, which may be used to determine the module type, the port being used to access the module, and certain operational parameters of the module. Table 7-6 provides an overview of these registers.

Table 7-6   Module Identification Registers

Register	Legal Values	Definition
8177		Packed ASCII module identification. Space Padded.
8178		Packed ASCII module identification. Space Padded.
8179		Packed ASCII module identification. Space Padded.
8180		Packed ASCII module identification. Space Padded.
8181		Packed ASCII module identification. Space Padded.
8182		Packed ASCII module identification. Space Padded.
8183		Packed ASCII module identification. Space Padded.
8184		Packed ASCII module identification. Space Padded.
8185		Packed ASCII module identification. Space Padded.
8186		Packed ASCII module identification. Space Padded.
8188	9990 (hex)	Constant 9990(hex). Indicates NR&D module with name starting at Reg. 8177.

For example, if the CAT2 has a Firmware revision of 29JAN98, Registers 8177..8186 would have the values in Table 7-7.

Table 7-7   Module ID Example

Register	Values (hex)	Packed ASCII Values
8177	4341	CA
8178	5432	T2
8179	2032	2
8180	394A	9J
8181	414E	AN
8182	3938	98
8183	2020	
8184	2020	
8185	2020	
8186	2020	

8
Connector Pinouts

Port 1 Female RS-232 RNIM data port (DE9S with screw lock)

1   No Connection

2   RX receive data (from modem)

3   TX transmit data (to modem)

4   Pulled up to 10VDC

5   Signal Ground

6   No Connection

7   RTS (output) goes high on Push-to-Talk

8   CTS (input) must be high to transmit
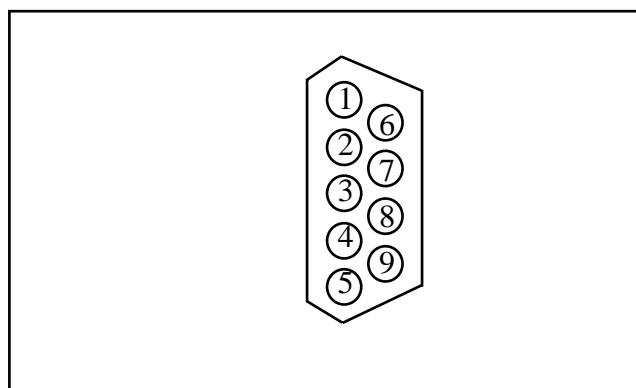
9   No Connection

Figure 8-1   Port 1 DE9S Pin configuration

Port 2 Male RS-232 Modbus data port (DE9P with screw lock)

1 No Connection

2 RX receive data (from Slave)

3 TX transmit data (to Slave)

4 Pulled up to 10VDC

5 Signal Ground

6 No Connection

7 RTS (output) goes high on Push-to-Talk

8 CTS (input) must be high to transmit
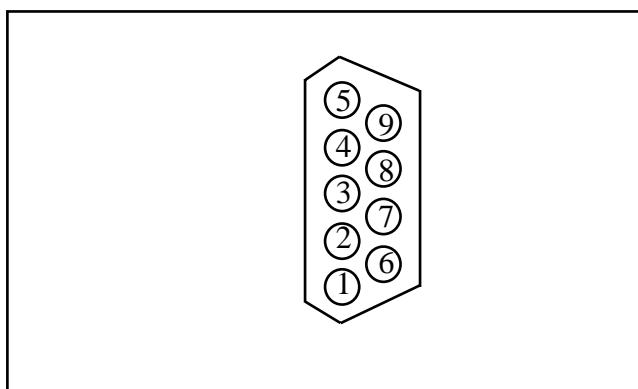
9 No Connection

Figure 8-2 **Port 1 DE9P Pin configuration**

9
Recommended Cabling

RS-232 Configuration Cable

9-Pin Female	9-Pin Male
1	1
2 ——————— 3
3 ——————— 2
4 ——————— 6
5 ——————— 5
6 ——————— 4
7	7
8	8
9	9

This cable may be used to connect a 9-pin RS-232 personal computer port to Port 1 of the CAT2 for configuration with CATSW. This cable may also be used to connect a personal computer's RS-232 COM port to the Modicon PLC for programming.

25 pin RS-232 Modem Cable

9-Pin Male	25-Pin Male
1	
2 ———————————— 3	
3 ———————————— 2	
4	
5 ———————————— 7	
6	
7 ———————————— 4	
8 ———————————— 5	
9	6
	8
	20
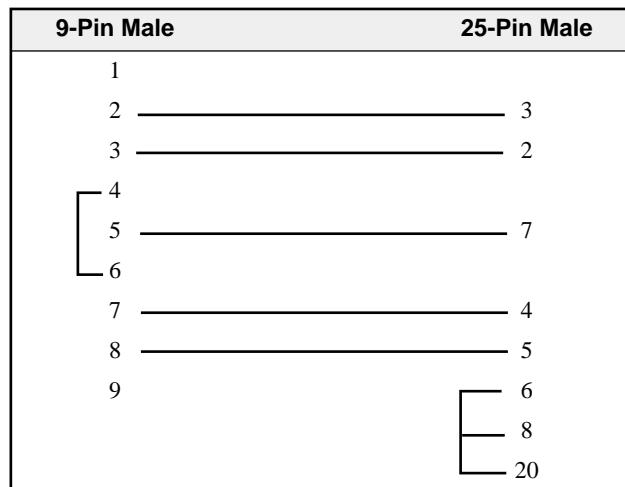
This cable may be used to connect the 9-pin RS-232 Port 2 of the CAT2 to a 25 pin RS-232 modem.

Appendix A
NR&D Internet Access

Niobrara is on the World Wide Web! Our Internet home page is at:

http://www.niobrara.com

where you will find product information, file downloads, and links to our distributors.

You may E-mail technical support at the following:

techsupport@niobrara.com