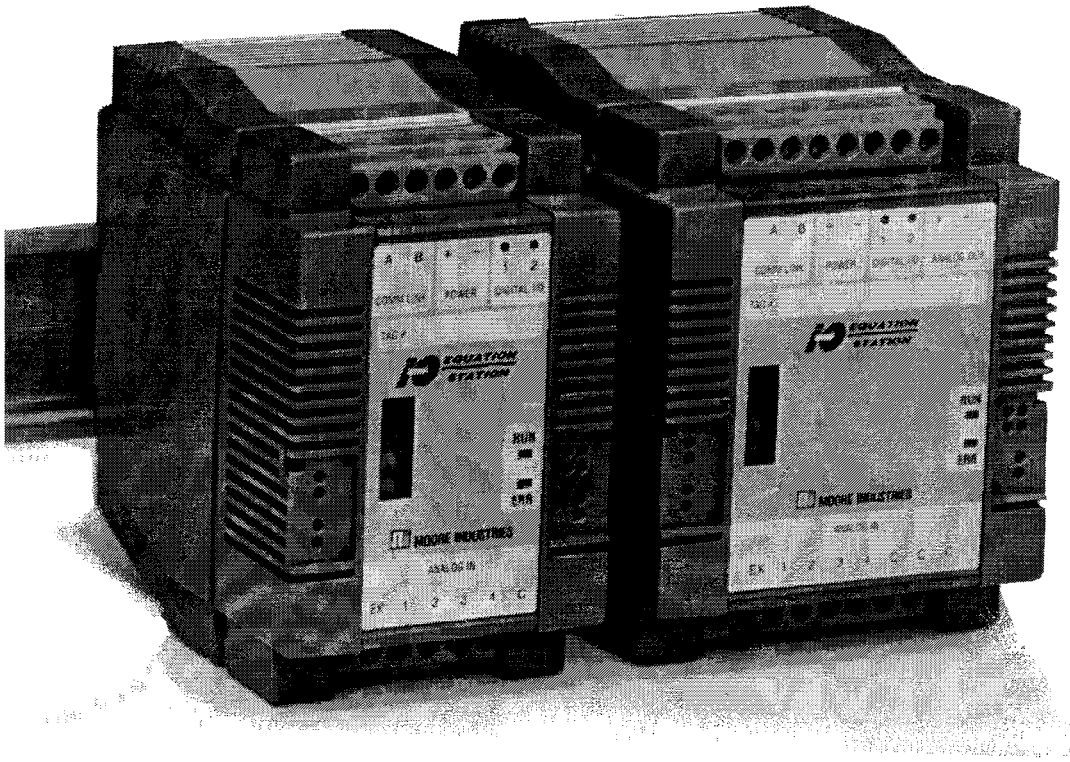
MOORE INDUSTRIES

USERS' MANUAL

EQUATION STATION

November 1995

Multifunction Distributed I/O System



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Quick Start...

LAUNCH
"MDSCNFG.EXE" **(page 20)**

VERIFY/CHANGE
the communications protocol (page 22)

UPLOAD
the Configuration File from the module (page 26)

OPEN (START)
(optional) a different/new Configuration File (page 30)

SET
(optional) the module and user name (page 32)

ADD or DELETE
Variables (page 34)

MODIFY
the parameters of the variables (page 39)

TEST
the Active Configuration File (page 65)

SET/CHANGE
the module Communications Address, etc. (page 66)

DOWNLOAD
the Configuration File (page 72)

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the Configuration File (page 73)

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Introduction

The ***I/O EQUATION STATION*** is the name given Moore Industries' family of ***M***ultifunction, ***D***istributed I/O ***S***ystem (MDS) modules. Taking the next step in the evolution of signal conditioning, the site-configurable modules of the ***I/O EQUATION STATION*** are designed to be individually tailored to work in applications ranging from simple sensor-level I/O, to sophisticated distributed intelligence in process control.

MDS modules free computer or controller resources for higher-level tasks by carrying out rudimentary functions in the field; functions that might otherwise have to be performed by the control room equipment.

This manual describes the different types of MDS module, lists specifications, gives instructions for the installation and use of the configuration software, and tells how to hook up modules to a PC, to I/O, and to other MDS modules.

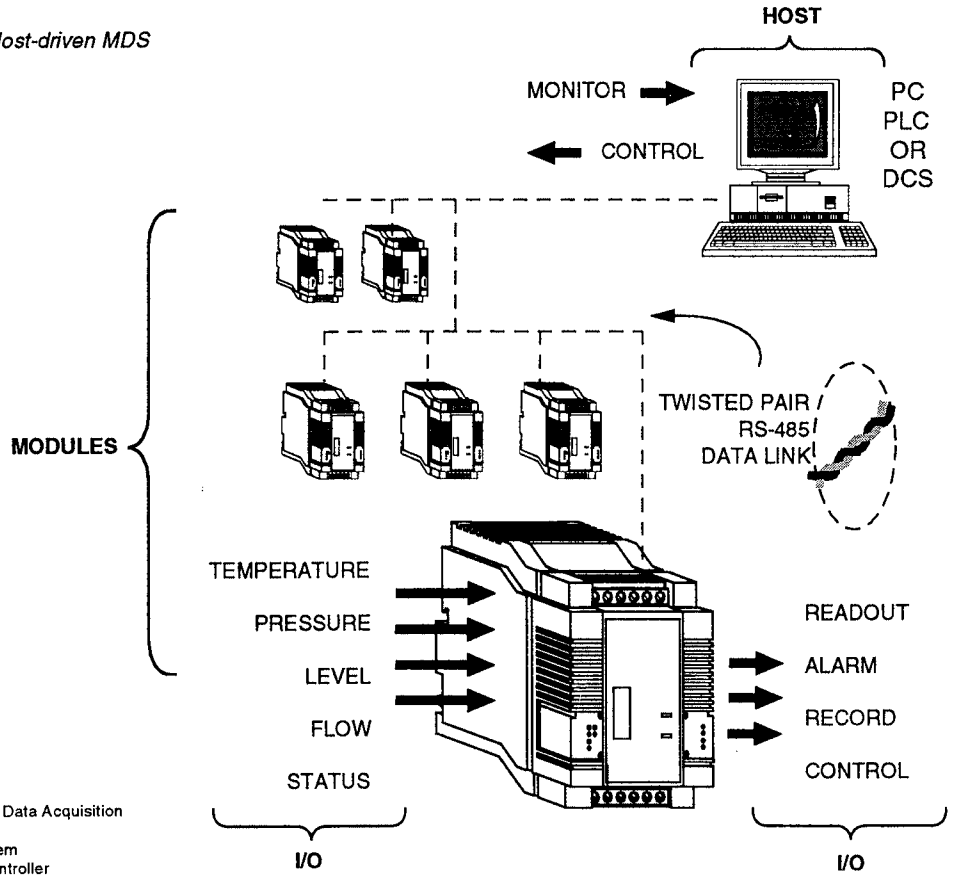
System Overview — Host-based or Stand-alone Applications

In your process, the DIN-mounted modules of the MDS can be used in either of two ways.

- They interface $SCADA_1$, MMI_2, or DCS_3 hosts or $PLCs_4$ to a distributed network of field I/O devices
- They act as stand-alone I/O devices, providing distributed signal conditioning, alarm, logic, and arithmetic functionality without host intervention.

Figure 1 shows a simple, overview diagram of how a "Hosted" ***I/O EQUATION STATION*** works. "Hostless" systems must be configured with a personal computer (PC) first, then installed in a fashion similar to the one in the figure.

Figure 1. *A Basic, Host-driven MDS*



1 Supervisory Control and Data Acquisition
2 Man-Machine Interface
3 Distributed Control System
4 Programmable Logic Controller

I/O EQUATION STATION

Modules Types

MDS modules come in three types. The types are distinguishable by their physical I/O configuration; that is, the combination of available I/O terminals on the module. See Figure 2.

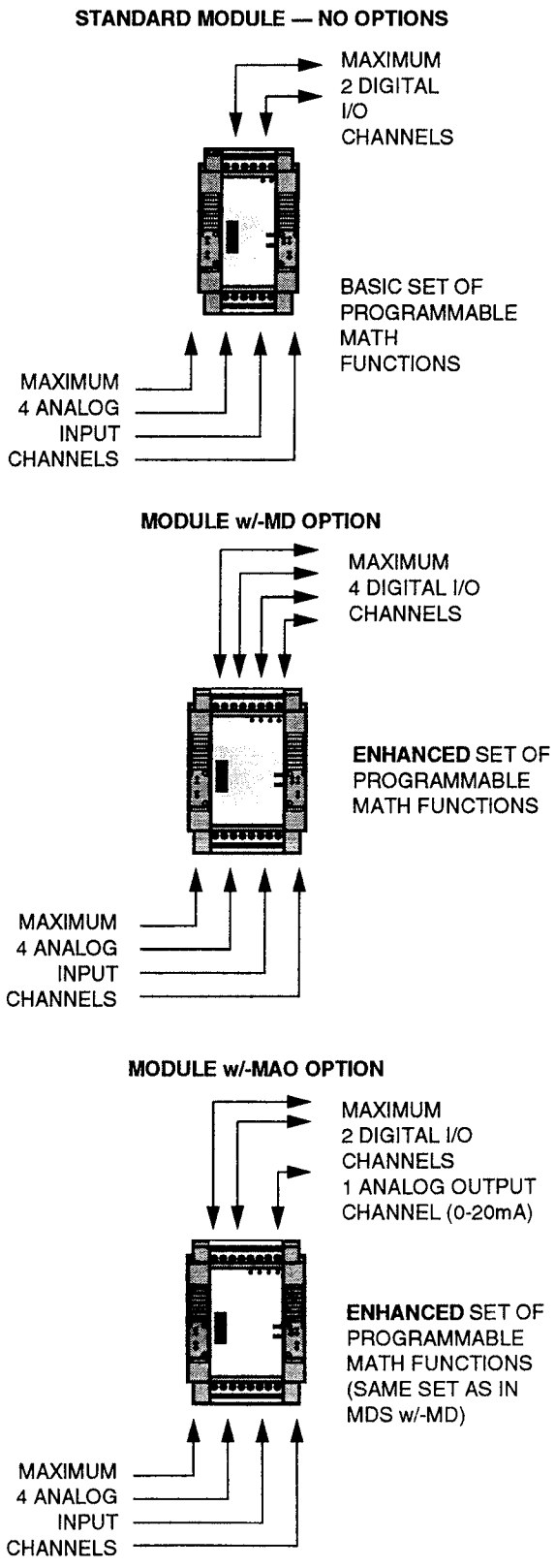
- The standard MDS can accommodate a maximum of 4 analog inputs and 2 digital inputs or outputs
- The MDS-MD can accommodate a maximum of 4 analog inputs and 4 digital inputs or outputs
- The MDS-MAO can accommodate a maximum of 4 analog inputs, 2 digital inputs or outputs, and 1 analog output

Systems

A maximum of 127 MDS modules can be inter-linked to form an ***I/O EQUATION STATION*** (repeaters and additional power supplies may be required). Modules can be configured to accommodate a maximum of 1016 I/O points in a given system.

Groups of modules installed close to one another can be interconnected with our specially designed Data Communications Link plug, or modules can be deployed separately, covering a total distance of more than 1 mile (depending upon baud rate programming and other physical and environmental factors).

Figure 2. *The Three Available Types of MDS Module*



I/O Devices — User-Defined Configuration

Unless otherwise specified, MDS modules are shipped with a default I/O configuration consisting basically of the accommodation for a single, –10 to +10Vdc, process variable. Use the PC-based software included with each ***I/O EQUATION STATION*** shipment to change module configuration to meet the requirements of the intended application.

Inputs, Analog — All 3 types of MDS module accept:

- Current sources
- Voltage sources
- Strain gauges (Wheatstone resistance bridges)
- Potentiometers
- RTDs
- Resistance sources
- Thermocouples

Inputs, Digital — All 3 types of MDS module accept:

- Status indicators (on/off)
- Frequency sources
- Counters (up/down, cumulative, and quadrature)

Output, Analog — Modules equipped with the -MAO option provide 0-20mA current output.

Outputs, Digital — All 3 types of MDS module can provide Host-controlled outputs, outputs based on other variables being processed by the module (process-controlled), or pulse-width modulated outputs based on user-designated analog input.

Processing, Arithmetic/logical — All modules can perform the following operations using formulas entered during configuration:

- Addition
- Subtraction
- Multiplication
- Division
- Absolute Value
- Alarm with Boolean OR
- Lowest value since last reset
- Highest value since last reset

In addition to the standard math, modules equipped with Enhanced Math — the "M" in both the -MD and -MAO options — can also be configured to calculate/use:

- Square Root
- Exponential derivations
- Natural logarithm determinations
- Base10 logarithm determinations
- Minimum of specified series
- Maximum of specified series
- Sine, cosine, and tangent
- Arc sine, arc cosine, and arc tangent
- Integral Functions
- Derivative Functions

Custom Inputs

In addition to the input types available in the standard input library, all module types can be configured to accommodate "customized" sensors (inputs) with their own linearization curves. Consult the factory for details.

EQUATION STATION

Specifications

The following section details the specifications for the configurations possible in MDS modules. Table 1, on pages 5-7 following the specifications lists, summarizes the range, accuracy, resolution, and error (where applicable) for each I/O type.

Table 2, on page 8, summarizes module throughput times. Refer to "Ordering Information" for information needed to "build" an MDS model number if ordering additional or replacement modules.

Specifications *(Refer to Table 1 for Range, Accuracy, Resolution specs; to Table 2 for Throughput.)*

Digital Input Performance

Contact closure; 22kΩ pull-up to input power positive (Thresholds for voltage sources <1V guaranteed low >3.5V guaranteed high

Status Input Logic: Closed contact is logic 1

Frequency Measurement Time Base (period over which counter accumulates input pulses): User-set, 0.1 to 10secs
Frequency Input min ON or OFF time: Standard module, 20µsec with 1 input, 250µsec with 2 inputs; MD and MAO equipped modules, 20µsec with 1 or 2 inputs

Pulse Counter Resolution: 16-bit in MODBUS RTU, 32-bit in PROFIBUS
Pulse Counter Reset: Register can be reset by any designated variable exceeding 0.5, by direct digital input, or by Host writing to counter register
Pulse Counter Input min ON or OFF time: See Frequency spec

Up/Down Counter Resolution: 16-bit in MODBUS RTU, 32-bit in PROFIBUS
Up/Down Counter Logic: Pulse on channel #1 increments count when channel #2 is logic 0; Pulse on channel #1 decrements count when channel #2 is logic 1; Register can be reset by any designated variable exceeding 0.5, by direct digital input, or by Host writing to counter register
Up/Down Counter Input min ON or OFF time: 250µsec
Maximum Frequency: 2kHz

Digital Input Performance (continued)

Quadrature Counter Resolution: 16-bit in MODBUS RTU, 32-bit in PROFIBUS;
Quadrature Logic: Count increments when state of channel #1 = state of channel #2 and channel #1 changes state; Count decrements when state of channel #1 ≠ state of channel #2 and channel #1 changes state; Register can be reset by any designated variable exceeding 0.5, by direct digital input, or by Host writing to counter register
Quadrature min ON or OFF time: 250µsec

Digital Output Performance

Maximum Frequency: 2kHz
Open Collector, 30V, 100mA

Status Output Logic: Logic 0 is open collector

Pulse-Width Modulated Output Frequency: User-set at 0.1, 1, or 100Hz

Analog Input Performance

RTD Excitation Current: 0.5mA

Potentiometer and Bridge Excitation: 5V, 50mA, max

Voltage Input Impedance: 100MΩ

Current Input Impedance: 100Ω

Isolation: 500Vrms, analog inputs to power to COMM port; (Digital I/O not isolated from power supply); Analog output (-MAO option) isolated 500Vrms from analog inputs, COMM port, power, and digital I/O

Analog Input Performance (continued)

Common Mode Rejection: 100dB @ 50/60Hz

Normal Mode Rejection: 40dB @ 50/60Hz

RFI/EMI Effect: 10V/m between frequencies of 20-500MHz

Burnout Protection: Thermocouple inputs upscale on sensor failure; **Bias Current:** 150nA

A/D Converter Rate: User-set, 50-200 measurements per sec

A/D Conveter Response: Dependent on Rate setting and # of inputs configured; 5 cycles to reach rated accuracy for step input. See Table 2 for cycle times

Analog Output Performance

14-bit, scaleable 0-20mA (up to 22mA for overdrive)

Step Response: Less than 10msec from 10 to 90% output in response to step change

Compliance: 24V min, 30V max

Load Capability: 1.2KΩ @ 20mA

Load Effect: 2µA/500Ω change

Ripple: <10mV, peak-to-peak into 250Ω, 120Hz or less

Power Supply Effect: 1µA/10V change

Integration Function Performance

Update Rate: 10 times/sec

Accuracy: ±0.1%

Units of integrator result: 1 unit/sec/unit input

Derivative Function Performance

Sample/Update Rate: Equivalent to total program execution time

Accuracy: ±3.0%

Units of Derivative Result: 1 unit for a 1 unit/sec change on input

(continued next page...)

Specifications *Continued (Refer to Table 1 for Range, Accuracy, Resolution)*

Power Supply 10 to 30Vdc, 1.5W maximum (2.7W maximum with -MD or -MAO option)

Protection: Transient protected with thermal reset fuse and reverse-polarity protected

Inrush Current: <1A for 20msec, typical at 10Vdc

Communications RS-485, half-duplex (according to EIA-485 standard, 1983)

Address Range: 1 to 127
Protocol: MODBUS RTU (factory default), PROFIBUS is selectable in configuration software

Communications (continued) **Baud Rate:** User-set according to protocol selected; MODBUS RTU: 2400, 4800, 9600, 19.2K, 38.4K; PROFIBUS: 9600, 19.2K, 38.4K, 93.75K, 187.5K

Character Formats (parity-data bits-stop bits): User-set N-8-1, N-8-2, E-8-1, or 0-8-1
(factory default is N-8-1)

Range: 1.6km (1 mile) typical at 9600 baud over 20AWG twisted pair; 0.8km (0.5 mile) typical at 19.2K baud

Ambient Conditions **Operating Range:** -20°C to +60°C (-25°F to +140°F)

Ambient Temperature Effect: ±0.01% of range/°C

Ambient Conditions (continued) **Storage Range:** -30°C to +85°C (-22°F to +185°F)

Relative Humidity: 0-95%, non-condensing (@ 50°C)

Indicators Front panel LEDs indicate COMM link activity, RUN (all functions executing properly), and ERR (COMM link fault, I/O overange, or internal fault)

Adjustments All operating parameters are downloaded from the PC over the communications link; a copy of the configuration software is provided with each order

Weight Standard Model: 198 g (7 oz.)
with -MD Option: 255 g (9 oz.)
with -MAO Option: 284 g (10 oz.)

Table 1. I/O EQUATION STATION MDS Module Accuracy

I/O Type	Range	Accuracy	Resolution	Other
Frequency	Standard MDS: 0-25kHz with 1 channel, 0-2kHz with 2 channels MDS w/MD or MAO: 0-25kHz	(1 + 0.016% of reading) ÷ timebase	1 ÷ time base	Time base, user-set from 0.1 to 10 seconds, is the period during wihich a counter accumulates input pulses.
Pulse Counter	Standard MDS: 0-25kHz with 1 channel, 0-2kHz with 2 channels MDS w/MD or MAO: 0-25kHz	n/a	16-bit with MODBUS RTU; 32-bit with PROFIBUS	
Up/Down Counter	0-2kHz	n/a	16-bit with MODBUS RTU; 32-bit with PROFIBUS	
Quadrature Counter	0-2kHz	n/a	16-bit with MODBUS RTU; 32-bit with PROFIBUS	
Current (Input)	0-6.25µA	±0.3% of Range	15-bit	n/a
	0-250µA	±0.1% of Range		
	0-1.0mA	±0.05% of Range		
	0-3.125mA	±0.2% of Range		
	0-6.25mA	±0.1% of Range		
	0-12.5mA	±0.05% of Range		
	0-20mA	±0.05% of Range		

(continued next page...)

Table 1 (continued). ***I/O EQUATION STATION*** *MDS Module Accuracy*

I/O Type	Range	Accuracy	Resolution	Other
Current (Output)	0-25mA	±0.05% of range	14-bit	
Voltage	–6.25 to 6.25mV	±0.3% of Range	15-bit	
	–25 to 25mV	±0.1% of Range		
	–100 to 100mV	±0.03% of Range		
	–312.5 to 312.5mV			
	–625 to 625 mV			
	–1.25mV to 1.25 mV	±0.03% of Range		
	–2.5 to 2.5V			
	–5 to 5V			
	–10 to 10V			
Bridge (Strain Gauge)	0.625mV/V	±0.3% of Range	15-bit	
	2.5mV/V	±0.1% of Range		
	10mV/V	±0.03% of Range		
	31.25mV/V	±0.3% of Range		
	62.5mV/V	±0.3% of Range		
	125mV/V	±0.1% of Range		
	0.25V/V			
	0.5V/V			
	1V/V			
Potentiometer	100 to 20kΩ	±0.03% of Pot Span	15-bit	
Resistance 2-, 3-, 4-Wire	200Ω	±0.05% of Range	15-bit	
	312.5Ω			
	625Ω			
	1.25kΩ			
	2.5kΩ			
	5kΩ			
	10kΩ			
	20kΩ			
RTD Pt100 0.00385Ω/Ω/°C	–200 to 250°C (–328 to 482°F)	±0.26°C	0.02°C	0.03°C Conformance Error
	–220 to 550°C (–320 to 1022°F)	±0.04°C	0.03°C	0.08°C Conformance Error
	–200 to 850°C (–328 to 1562°F)	±0.81°C	0.05°C	0.16°C Conformance Error
RTD Pt500 0.00385Ω/Ω/°C	–200 to 400°C (–328 to 752°F)	±0.32°C	0.02°C	0.06°C Conformance Error
	–200 to 850°C (–328 to 1562°F)	±0.65°C	0.04°C	0.17°C Conformance Error
RTD Pt1000 0.00385Ω/Ω/°C	–200 to 50°C –328 to 122°F)	±0.16°C	0.04°C	0.01°C Conformance Error
	–200 to 400 °C (–328 to 752°F)	±0.32°C	0.08°C	0.04°C Conformance Error
	–200 to 850°C (–328 to 1562°F)	±0.65°C	0.2°C	0.16°C Conformance Error

(continued next page...)

Table 1 (continued). ***I/O EQUATION STATION*** *MDS Module Accuracy*

I/O Type	Range	Accuracy	Resolution	Other
RTD Ni100 0.00168Ω/Ω/°C	–60 to 180°C (–76 to 356°F)	±0.3°C	0.02°C	0.01°C Conformance Error
RTD Ni120 0.00672Ω/Ω/°C	–80 to 320°C (–112 to 608°F)	±0.5°C	0.03°C	0.13°C Conformance Error
Thermocouple Type J	0 to 450°C (32 to 842°F)	±1.0°C @ 0°C ±0.91°C @ 450°C	0.03°C	0.01°C Conformance Error
	–210 to 1200°C (–346 to 2192°F)	±3.0°C @ –210°C ±1.1°C @ 1200°C	0.3°C	0.28°C Conformance Error
Thermocouple Type K	0 to 600°C (32 to 1112°F)	±1.3°C @ 0°C ±1.2°C @ 600°C	0.04°C	0.02°C Conformance Error
	–100 to 1370°C (–148 to 2498°F)	±1.9°C @ –100°C ±1.8°C @ 1370°C	0.2°C	0.23°C Conformance Error
Thermocouple Type E	–50 to 350°C (–58 to 662°F)	±0.96°C @ –50°C ±0.62°C @ 350°C	0.03°C	0.04°C Conformance Error
	–200 to 1000°C (–328 to 1832°F)	±2.3°C @ –200°C ±0.8°C @ 1000°C	0.2°C	0.25°C Conformance Error
Thermocouple Type R	0 to 650°C (32 to 1202°F)	±7.5°C @ 0°C ±3.1°C @ 650°C	0.08°C	0.11°C Conformance Error
	–50 to 1460°C (–58 to 2660°F)	±17°C @ –50°C ±3.6°C @ 1460°C	0.5°C	0.38°C Conformance Error
Thermocouple Type S	0 to 650°C (32 to 1202°F)	±7.5°C @ 0°C ±3.1°C @ 650°C	0.08°C	0.08°C Conformance Error
	–50 to 1460°C (–58 to 2660°F)	±12°C @ –50°C ±4.2°C @ 1460°C	0.4°C	0.32°C Conformance Error
Thermocouple Type T	–50 to 140°C (–58 to 284°F)	±1.1°C @ –50°C ±0.75°C @ 140°C	0.01°C	0.01°C Conformance Error
	–270 to 400°C	±25.0°C @ –270°C ±0.08°C @ 400°C	0.08°C	0.36 Conformance Error
Thermocouple Type B	500 to 1100°C (932 to 2102°F)	±7.5°C @ 500°C ±3.8°C @ 1100°C	0.2°C	0.36°C Conformance Error
	750 to 1540°C (1392 to 2804°F)	±6.9°C @ 570°C ±4.4°C @ 1540°C	0.2°C	0.06°C Conformance Error
Pulse-width Modulated Output	1-99% Duty Cycle	–	10msec for 0.1 and 1.0 Hz, 1µsec for 100 Hz	–

Other Thermocouple types and ranges available. Consult Factory for details.
Cold Junction Compensation Error ±0.5°C @ 25°C, ±0.005°C/°C (-ICJ Option required)

I/O EQUATION STATION

Table 2. I/O EQUATION STATION MDS Modules' Input Signal Response/Cycle Time

Number of Inputs	Time to Scan @ 50Hz Measurement Rate	Time to Scan @ 60Hz Measurement Rate	Time to Scan @ 200Hz Measurement Rate
1	20.0msec	16.7msec	5.0msec
2	200.0msec	166.7msec	50.0msec
3	300.0msec	250.0msec	75.0msec
4	400.0msec	333.3msec	100.0msec

Type of Variable	Time to Execute/Calculate
Analog Input	5msec
Analog Output	1.2msec
Digital Input, Status	0.3msec
Digital Input, Counter (All types)	0.4msec
Digital Input, Frequency	1.0msec
Digital Output, Host-controlled	0.8msec
Digital Output, Process-controlled	1.4msec X # of conditions set
Digital Output, Pulse-width Modulated	0.8msec
Alarm	0.4msec X # of conditions set
Setpoint	0.3msec
Arithmetic	0.6msec + operand time
Operand	**Time to Execute/Calculate**
Addition, Subtraction, Multiplication	0.8msec*
Division	1.1msec*
Square Root	2.68msec*
Exponential	3.92msec*
Absolute Value	0.1msec*
Natural Log	3.7msec*
Base 10 Log	3.8msec*
Integrate	0.8msec*
Generate Derivative	1.6msec*
Sine	3.2msec*
Cosine, Tangent	3.6msec*
Arc Sine	3.2msec*
Arc Cosine	7.0msec*
ArcTangent	3.2msec*
Minimum, Maximum	0.1msec*
Low, High	1.4msec*

* Cycle time per implementation of the function.

3- or 4-Wire Resistance/RTD measurements require more than 1 input, taking 2 cycles to complete a reading.

To calculate module throughput, add measurement rate time for inputs to total of execution/calculation time(s) for all variables. For Throughput to a Host, include allowances for baud rate setting, # of modules on the Data Link and the module throughput times for each, the amount of data being transmitted, and any Host Comm Port limitations.

EQUATION STATION

Ordering Information

Unit	Inputs	Output	Power	Options	Housing
MDS Multifunction Distributed I/O System	**PRG** Configures to accept: DIGITAL Two digital channels may be configured as either one input and one output, two inputs or two outputs (see-MD option to add two digital input/output channels to the standard model) CURRENT Up to four signals with ranges between 0 and 25mA (0-20mA, 4-20mA, etc.) VOLTAGE Up to four signals with ranges between -10V and +10V (0-5V, 1-5V, 0-10V, etc) or between -625mV and +625mV RTD Up to four 2-wire, two 3-wire, or one 4-wire RTD (Pt100, Pt500, Pt1000; Ni100, Ni120) THERMOCOUPLE Up to three thermocouples with cold junction compensation (J, K, E, T, R, S, N, B, U, L) BRIDGE 4-Wire and 6-Wire POTENTIOMETER RS-485 COMM LINK MODBUS RTU PROFIBUS	**PRG** Configures to output: DIGITAL Two digital channels may be configured as either one input and one output, two inputs or two outputs (see the -MD option to add two digital input/output channels to the standard model) ANALOG OUTPUT (OPTIONAL) Specify the -MAO option to add a current output (0-20mA range; up to 22mA for overdrive) RS-485 COMM LINK MODBUS RTU PROFIBUS	**10-30DC** (1.5 watts max.)	**-MD** Adds two additional digital input/output channels and an Enhanced Math Package to the standard model (can not be ordered with -MAO option) **-MAO** Adds one 4-20mA analog output channel and the Enhanced Math Package to the standard unit (can not be ordered with the -MD option) **-ICJ** Internal Cold Junction Compensation terminal block (required for use with internally compensated T/C inputs)	**DIN** DIN-style housing with removable terminal blocks mounts on standard Top Hat (DIN 46277-3) rail

When ordering, specify: Unit / Input / Output / Power / Options [Housing]
Model number example: MDS / PRG / PRG / 10-30DC / -MAO [DIN]

Accessories

To complement the capabilities of the ***I/O EQUATION STATION***, Moore Industries offers a set of companion components and products that make installation even easier, and enhance compatibility with previously installed hardware and/or software. Consult the factory for information and applicable part numbers.

DCL *- Data Communications/Power Link Plug*
This small, snap-on bridge takes the place of module-to-module data and power wiring. As many as six modules can be inter-connected by snapping DCLs into special holes on the front panels of adjacent modules.

DCT *- Data Communications Link Terminator Plug*
Plug this simple component into the last module on the link to provide the resistance needed to terminate the data bus.

LCM *- Link Converter Module*
This Moore Industries product interfaces the RS-485 communications signals of an MDS module any RS-232 board/port; commonly the COMx port found in PCs. The standard LCM includes its own, 9-pin, D sub-miniature connector/cable. Separate, regulated 24Vdc instrument power (150mA) is required.

DPS *- Instrument Power Supplies*
Moore Industries manufactures a full line of reliable, DIN-rail mounted power supplies.

MDSCNFG.EXE *- Moore Industries Configuration Software*
Each MDS ***I/O EQUATION STATION*** comes with Moore Industries' easy-to-use, Windows™-based configuration software, the MDS Configuration Program. In addition to configuring units, it provides a means of checking and tuning of basic operation and downloaded configuration. Contact Moore Industries for additional copies of the program, for updates, or for replacement diskettes.

Installation

I/O EQUATION STATION installation consists of four sub-procedures:

- First, install the software on a PC. Moore Industries ships both the Configuration Program and the on-line Help system (instructions start on page 11) with every ***I/O EQUATION STATION***. Help system installation is optional.
- Next, connect a module to the PC. (page 16)
- Compose and download a Configuration File, or choose and download a previously composed Configuration File. (page 18)
- Finally, physically install the module on DIN-rail and make the connections for power, data, and I/O (page 76).

Combining Installation Procedures

We suggest that ***I/O EQUATION STATION*** modules be installed in the order specified above. However, since the modules use the same Comm Link for configuration and actual operation in an application, it *is* possible to physically install units first, and then to carry out module configuration over the Comm Link.

CAUTION:
*If **I/O EQUATION STATION** modules that are already physically installed in a process application are to be configured/re-configured, de-activate that process beforehand in order to minimize any risk of corrupting the process output due to any faulty configuration.*

NOTE:
The same Host used to configure an MDS module can be used to operate and monitor it. Both programming and module operation can be executed over the same, digital Data Communications Link (Comm Link), though not simultaneously.

Hardware/Software Requirements

The Configuration Program, `mdscnfg.exe`, can be installed and run on the following:

- IBM PC™ or 100% PC-compatible clone with at least a 80386 microprocessor
- 4 megabytes (Mb) random access memory (RAM); 6Mb (or more) recommended
- Hard disk
- 3Mb free space (minimum) on hard disk
- MSWindows™, version 3.1 (or later)
- 1 RS-485 serial communications port (COM1 or COM2); ***OR*** RS-232C serial COM# port with 485-to-232 converter. Contact Moore Industries for information on our complete line of reliable, easy-to-use converters
- VGA display/graphics adapter
- 3.5-inch floppy disk drive
- Microsoft-compatible mouse
- *Optional:* Printer/Printer interface

NOTE:
The configuration program does not operate in "multi-master" topologies over a network. Moore Industries recommends its use as a stand-alone configuration package with the configuring PC employed as the sole host.

Installing the Configuration Program

Each *I/O EQUATION STATION* shipment comes with a set of diskettes containing Moore Industries' easy-to-use, Windows™-based Configuration Program, `MDSCNFG.EXE`. All aspects of unit configuration and tuning, and any checking of basic operation is set up and downloaded to MDS modules with this program.

NOTE:
This manual assumes a basic understanding of Microsoft Windows™ and PC operation. If you are not familiar with how to install and run programs in Windows, contact the factory.

Using Windows' Program Manager:

1. **Run Windows.**
2. **Place the Moore Industries diskette labeled "Installation Disk" into one of the floppy drives of the PC.**
3. **In Windows' Program Manager, pull down the "`File`" menu and choose "`Run...`"**
4. **In the "`Command Line:`" space, type:**
   `n:\setup`
   Where "*n*" is the designator for the drive in which the diskette was placed in Step 2.
5. **Click/Select "`Ok`" or press Enter.**

   After a brief pause, the screen shown in Figure 3 (on the next page) appears.
6. **The source drive/path should be showing in the "`Installation from:`" space. Correct any discrepancies, and enter the drive/path to the directory on your PC where the Configuration Program is to reside.**
7. **Click/Select "`Install`". A status screen is displayed as the necessary files are copied to the specified hard disk drive/path and decompressed. The program prompts for creation of a new directory if necessary.**

   Click/Select "`Quit`" during installation to abort the process.

NOTE:
The "`Options`" selection affords the user the opportunity to "customize" the software installation by specifying drivers to be excluded from the install. In most cases, this selection can be ignored. Contact Moore Industries for a list of the drivers available, or with any questions regarding "`Options`".

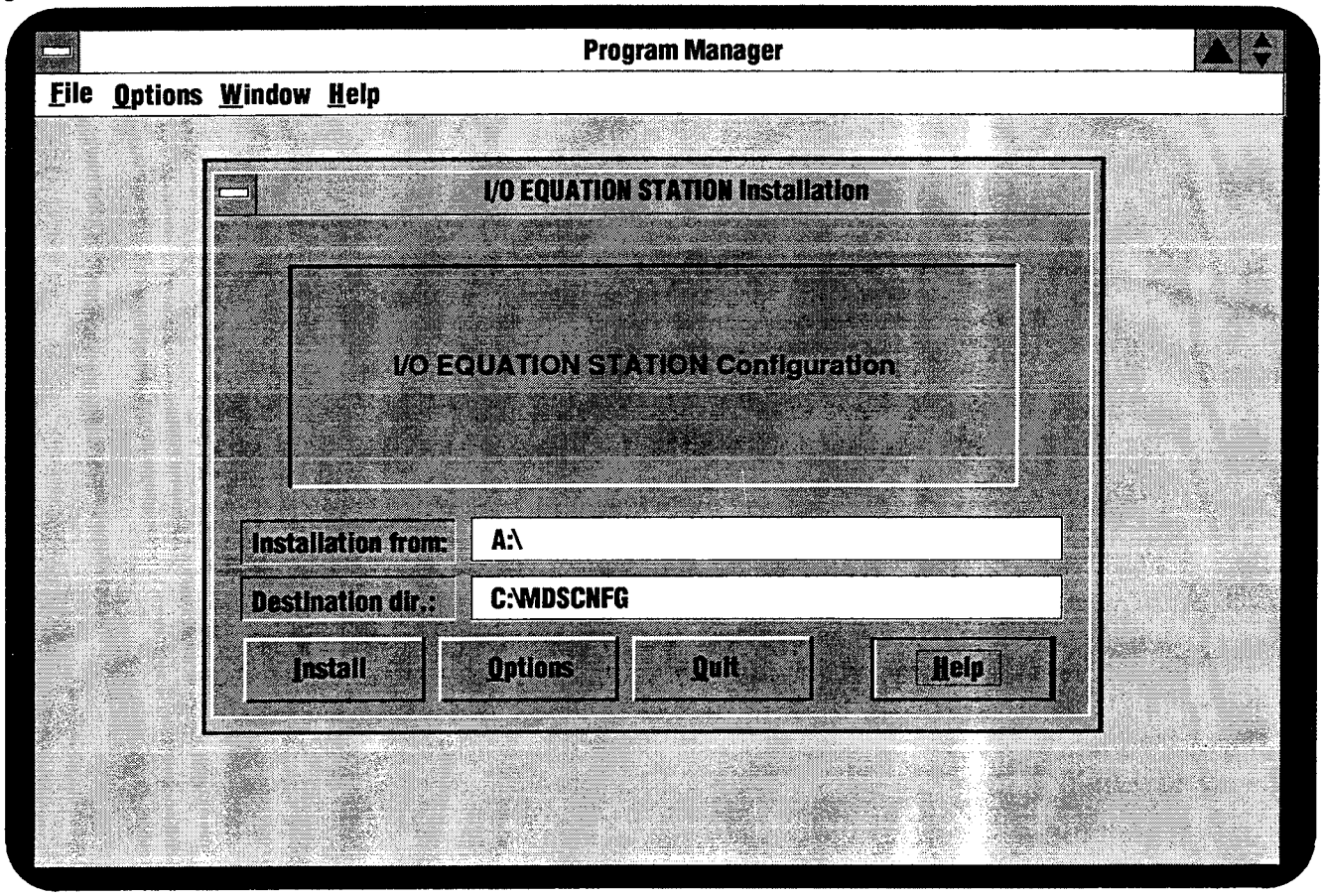
Using Windows' File Manager:

1. **Run Windows.**
2. **Place the Moore Industries diskette labeled "Installation Disk" into one of the floppy drives of the PC.**
3. **Launch Windows' File Manager.**
4. **Click/Select the drive in which the diskette was placed in Step 2.**
5. **Double-Click/Select "`setup.exe`" from the list of files shown.**

   After a brief pause, the screen shown in Figure 3 (on the next page) appears.

(Instructions for installation using Windows' File Manager continue...)

Figure 3. The I/O EQUATION STATION Configuration Program Installation Startup



(...continued from preceding page.)

6. **The source drive/path should be showing in the "`Installation from:`" space. Correct any discrepancies, and enter the drive/path to the directory on your PC where the Configuration Program is to reside.**

7. **Click/Select "`Install`".**

NOTE:
The "`Options`" selection affords the user the opportunity to "customize" the software installation by specifying drivers to be excluded from the install. In most cases, this selection can be ignored. Contact Moore Industries for a list of the drivers available, or with any questions regarding "`Options`".

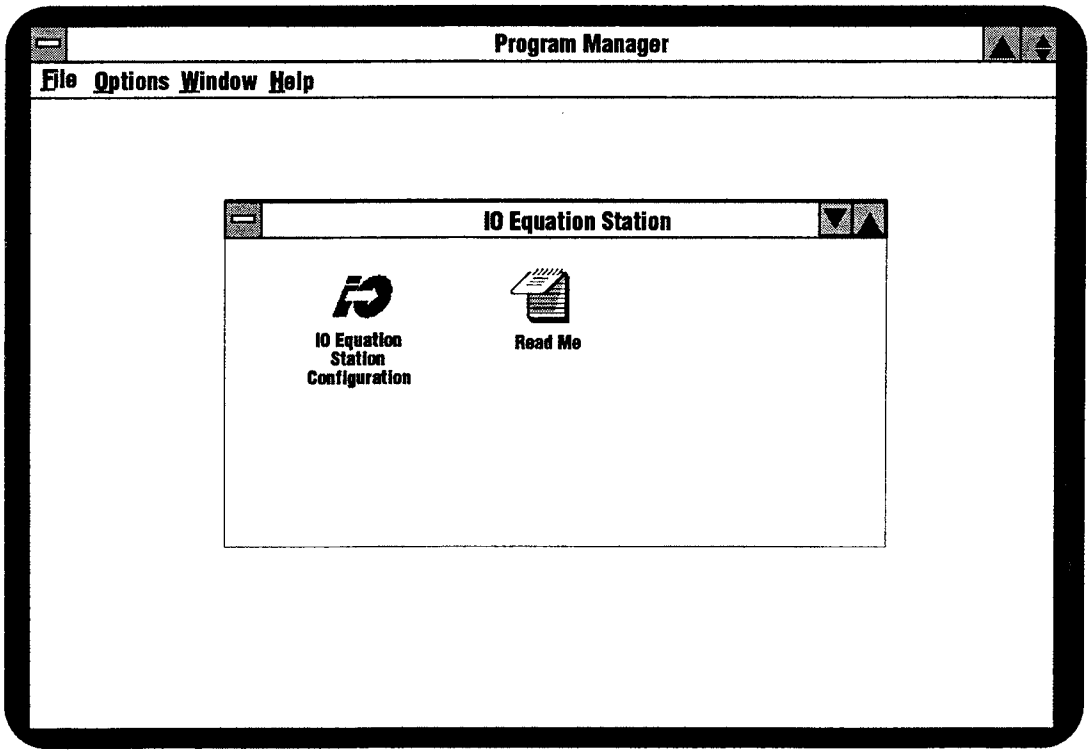
7. **A status screen is displayed as the necessary files are copied to the specified hard disk drive/path and decompressed. The program prompts for creation of a new directory if necessary.**

   Click/Select "QUIT" during installation to abort the process.

When the Install program is done, it creates a Windows Program Group that is subsequently accessible in Windows' Program Manager.

Figure 4 shows a typical Program Group. In some cases, an ASCII READ.ME file is included with the installation. This file can be read or printed with ant ASCII editor. It contains any last minute hints for MDS module configuration and operation.

Figure 4. Windows' Program Manager After MDSCNFG.EXE Installation



Installing the Help System

The Configuration Program comes with a fully cross-referenced, on-line help system, shipped on the diskette labeled "Help Disk". The Help System should be installed in the same directory as the Configuration Program.

Using Windows' Program Manager:

1. **Run Windows.**
2. **Place the Help diskette into one of the floppy drives.**
3. **In Windows' Program Manager, pull down the "File" menu and choose the "Run..." item.**
4. **In the "Command Line:" space provided in the dialog box that comes up, type:**
   n:\setup
   Where "*n*" is the drive letter in which the diskette was placed in Step 2.
5. **Click/Select "Ok" or press Enter.**
6. **The program displays a warning screen concerning system and shared file updates.**

   Click/Select "Ok".
7. **Next, the install program prompts for the name of the directory into which the Help system is to be installed. The default is "MDSCNFG".**
8. **If desired/required, correct the displayed directory/path following the instructions on the screen, then Click/Select "Ok".**

   A status screen shows the progress of the installation.
9. **Finally, the install program prompts for the name of a Windows Program Group for the Help System. The display shows a listing of the Program Groups available on the system.**

   Click/Select/Enter the name of the Program Group in which the Configuration Program resides, or the name of the a different group, and Click/Select "Continue".

   The program provides notification of its completion. Clicking "Ok" returns to Windows' Program Manager. Figure 5 shows a typical *I/O EQUATION STATION* Program Group.

Using Windows' File Manager:

1. **Run Windows.**
2. **Place the Help diskette into one of the floppy drives.**
3. **Launch the MSWindows File Manager, and Click/Select the drive containing the diskette.**
4. **Double-Click/Select the file "setup.exe" from the list of files shown.**
5. **The program displays a warning screen concerning system and shared file updates.**

   Click/Select "Ok".

   The program prompts for the name of the directory into which the Help system is to be installed. The default is "MDSCNFG".

6. **If desired/required, correct the displayed directory/path following the instructions on the screen, then Click/Select "Ok".**

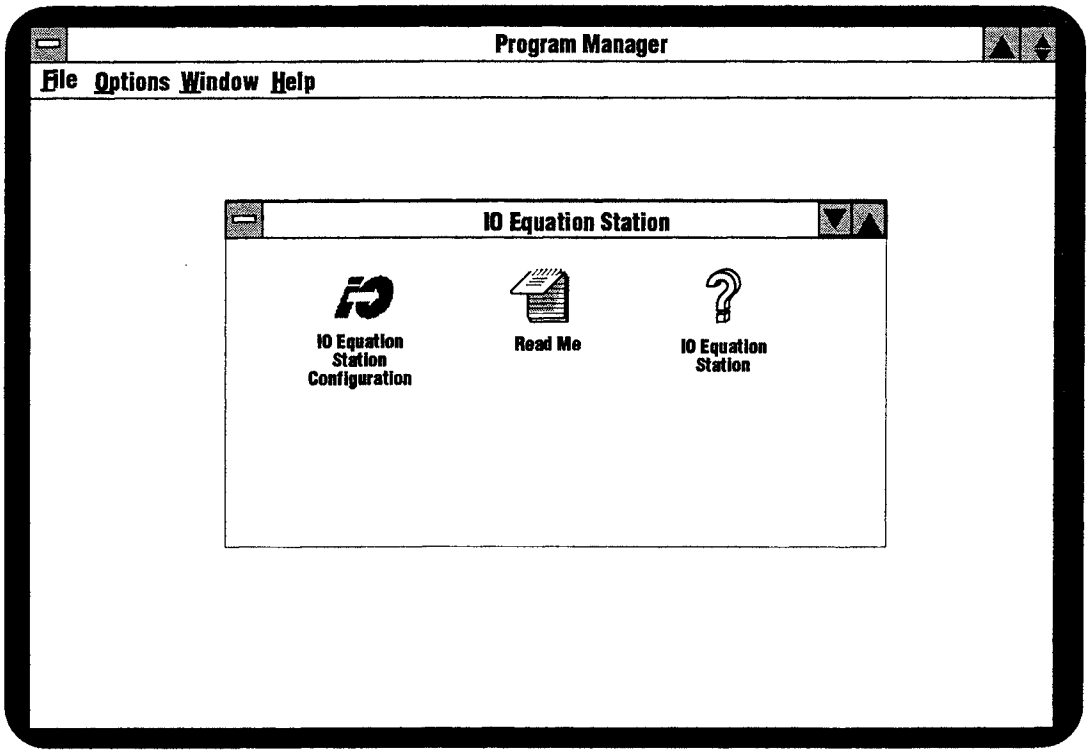
   A status screen shows the progress of the installation.

7. **Finally, the install program prompts for the name of a Windows Program Group for the Help System. The display shows a listing of the Program Groups available on the system.**

   Click/Select/Enter the name of the Program Group in which the Configuration Program resides, or the name of the a different group, and Click/Select "Continue".

   The program provides notification of its completion. Clicking "Ok" returns to Windows' Program Manager. Figure 5 shows a typical *I/O EQUATION STATION* Program Group.

Figure 5. Windows' Program Manager After MDSCNFG.EXE and the Help System Installation



EQUATION STATION

Configuring MDS Modules — Hardware Setup

Once the Configuration Program has been installed, refer to Figures 6 or 7 as appropriate, and set up an MDS module as shown.

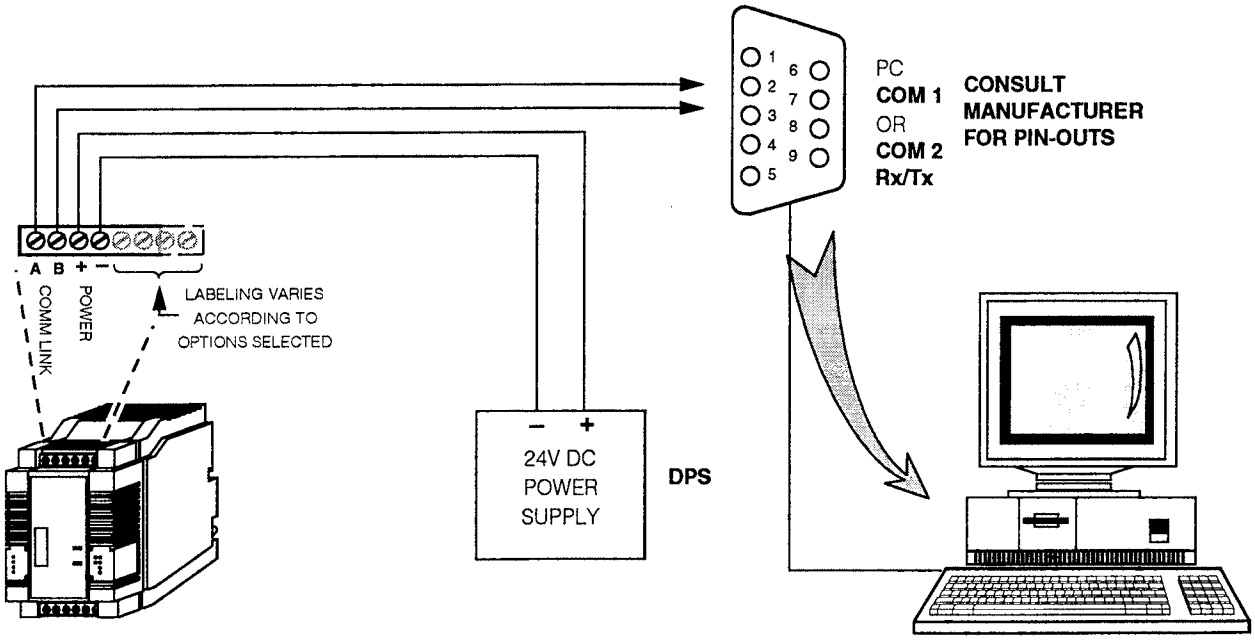
IMPORTANT:
Unless ordered with a non-default factory calibration, all MDS modules are shipped from the factory with MODBUS RTU protocol, a default address of 001, and a baud rate of 9600.

*"Brand new" MDS modules, therefore, can **only** be configured **one at a time**. Connecting more than one factory-default-configured module on a single Comm Link will result in communications collisions, disabling the link.*

Direct RS-485 Connections

MDS modules employ RS-485 parameters as specified in US standard EIA-RS485. To connect an MDS module or modules on the MDS Comm Link directly to an RS-485 board/port, check for information on pin-outs in the documentation for the board being used.

Figure 6. *Setup for Configuring an MDS Module Using Direct, RS-485 Connections*

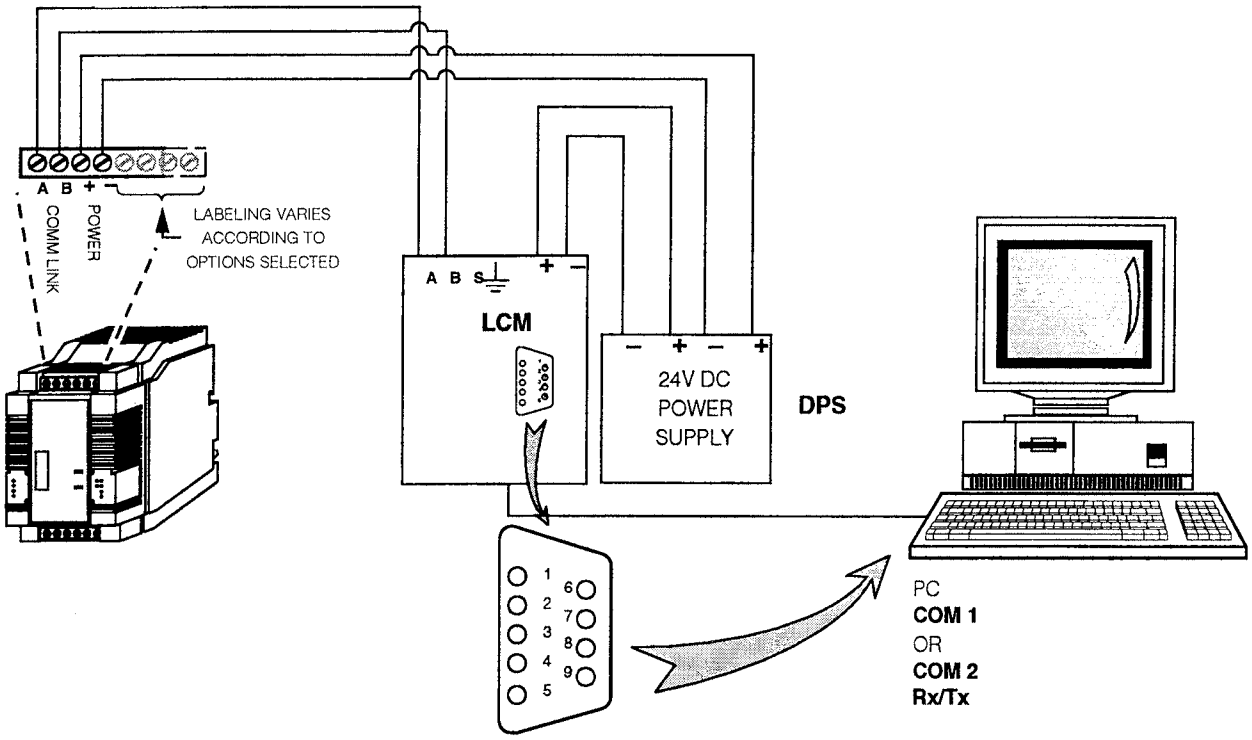


Using Moore Industries' LCM

Most PCs have at least one available RS-232 COM port. Moore Industries' Link Converter Module, the LCM, conveniently converts the RS-485 communications of the ***I/O EQUATION STATION*** to RS-232. Figure 7 shows that setup.

Contact the factory or your local Moore Industries Sales Representative for more information on our line of modems, LCM converter modules, and DPS Power Supplies.

Figure 7. *Setup for Configuring the MDS Modules Using Moore Industries' LCM*



LCM PIN	CONNECTION
1	not used
2	RXD
3	TXD
4	DTR (1kΩ pull-up resistor)
5	GND
6	not used
7	RTS (1kΩ pull-up resistor)
8	not used
9	not used

Configuring MDS Modules — Configuration Program Overview

MDS modules have no external controls. There are no pots to set, no jumpers to move, no buttons to push. All aspects of module operation are determined and stored in the form of program settings in non-volatile, internal module memory.

The Configuration Program, MDSCNFG.EXE, is the user's access to these settings.

To configure an MDS module, MDSCNFG.EXE is used to build a ***Configuration File*** of ***Variables***.

Variables are the building blocks of an MDS module's functioning. Together, all of the variables in a module's memory contain the instructions for what a module is to do, and how it is to do it.

A module's ***Configuration File*** is the repository for all its variables, communications parameters, and any identification tags.

Once completed, the Configuration File is typically downloaded to one or more modules in an application, then saved on disk for future use or reference.

The procedure for using the Configuration Program to set up an MDS module works like this:

1. **LAUNCH...**
   the Configuration Program. (page 20)

2. **VERIFY/CHANGE...**
   the communications protocol to be used.

   MDS modules are configured at the factory to operate using the MODBUS RTU protocol. If either the PROFIBUS or ASCII protocol is to be used in the *I/O EQUATION STATION* application, the protocol setting must be changed before building or downloading a Configuration File. (page 22)

NOTE:
If needed, always perform Step 2 ***before*** *Steps 3 through 10. Changing a module's communications protocol resets the configuration of its variables back to factory defaults. Any Configuration File that may have been previously downloaded to module memory is wiped out.*

3. **UPLOAD...**
   the Configuration File resident in module memory.

   This is an easy way to make sure that the Host and the connected MDS module are communicating properly. It also starts (opens) a new Configuration File. (page 26)

4. **(optionally, instead of Step 3) OPEN...**
   a different Configuration File on the Host disk,
   or
   START...
   a new Configuration File. (page 30)

   NOTE:
   Always establish communications with a module (Step 3) before working on its Configuration File, since changing communications parameters wipes out changes to variables' defaults.

5. **(optionally) SET...**
   the Module and User Name. (page 32)

6. **DELETE and/or ADD...**
   variables to the Configuration File. (page 34)

7. **MODIFY...**
   the parameters of variables as necessary. (page 39)

8. **TEST...**
   the active Configuration File and the basic operation of the module. (page 65)

9. **SET/CHANGE...**
   the module Communications Address and/or other Communications Parameters as necessary. (page 66)

10. **DOWNLOAD...**
    the Configuration File. (page 72)

11. **SAVE...**
    the Configuration File for future use or reference (page 73), and optionally, document the file contents on a copy of the appropriate worksheet in the back of this manual.

12. **CONNECT...**
    another module and repeat Steps 2-11.

Configuring MDS Modules — LAUNCH MDSCNFG.EXE

To run the Configuration Program, start in Windows' Program Manager, and double-click/Select the icon for the Configuration Program from within the ***I/O EQUATION STATION*** program group. A typical representation of the group is shown in Figure 5 on page 15.

Alternatively, use any of Windows' other methods of starting programs (the "**Run**" facility of the Program Manager, File Manager, etc.). Consult your Windows' documentation for further information.

The executable file that launches the Configuration Program is:

```
mdscnfg.exe
```

When the Configuration Program is launched, a screen showing an identification and program version flashes momentarily. This is followed by a dialog box which affords the user an opportunity to view a program Help Overview. This is shown in Figure 8.

To access the overview, Click/Select "**Help**".

To go directly to the program's Main Configuration screen, "**Cancel**".

To have the Configuration Program display this dialog box every time it launches, Click/Select the check box under "**Would you like to see this window again?**".

Figure 9 shows the Main Configuration screen as it appears when the Configuration Program is first loaded.

Figure 8. *Accessing the Help Overview On-Line*

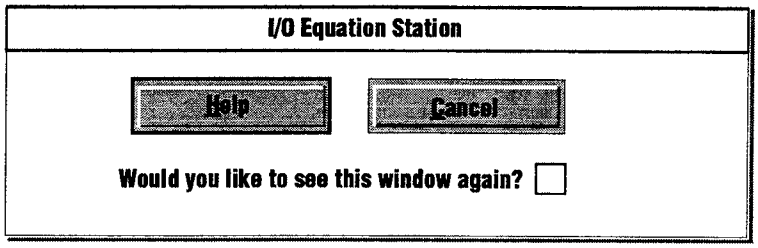
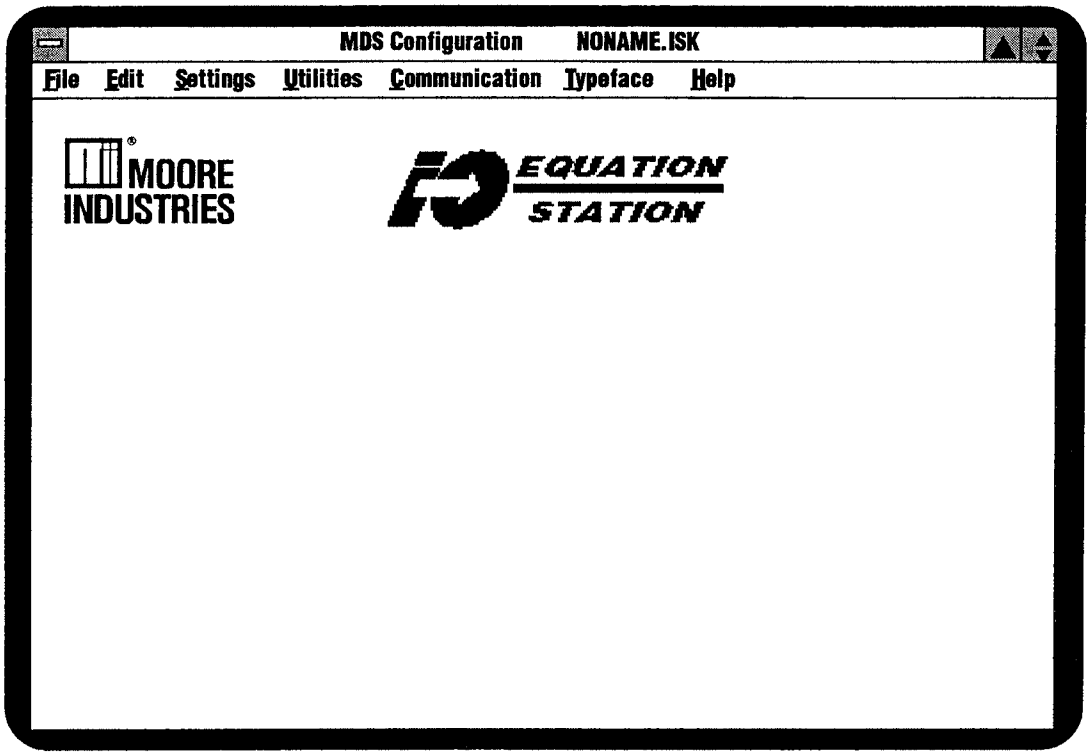


Figure 9. Initial View of the Main Screen for the MDS Configuration Program



Using the Configuration Program Help System

To access helpful information on any part of the Configuration Program, Click/Select the "**Help**" menu item on the Main Configuration screen (Figure 9), or press the function key <F1>. A list of Help topics is available under "**Contents**", as well as a search facility for on-line queries.

To bring up Help for a particular topic, Click/Select one of the colored/shaded menu items from the listing under "**Contents**". Note that each help screen has colored/shaded texts that, when Clicked/Selected, jump to related topics in the Help system.

Configuring MDS Modules — VERIFY/CHANGE the Communications Protocol

Use this procedure to change the protocol of the connected module from MODBUS RTU to PROFIBUS or ASCII, in order to fulfill Host and/or application requirements.

IMPORTANT:
If the Host or eventual application calls for the use of different parameters, make the switch before *beginning any work on a Configuration File.*

Downloading a protocol resets the Configuration File to its factory defaults. Settings for variables in any previously downloaded Configuration File will be lost.

Refer to page 66 for information on changing any module communication parameters other than the active protocol.

Unless otherwise specified by the customer, MDS modules are shipped from the factory configured to communicate with the following parameters:

- MODBUS RTU
- 9600 Baud
- No Parity
- 1 Stop Bit

If these settings are adequate for configuring the connected module(s), continued with the configuration process on page 26 with instructions on uploading a Configuration File.

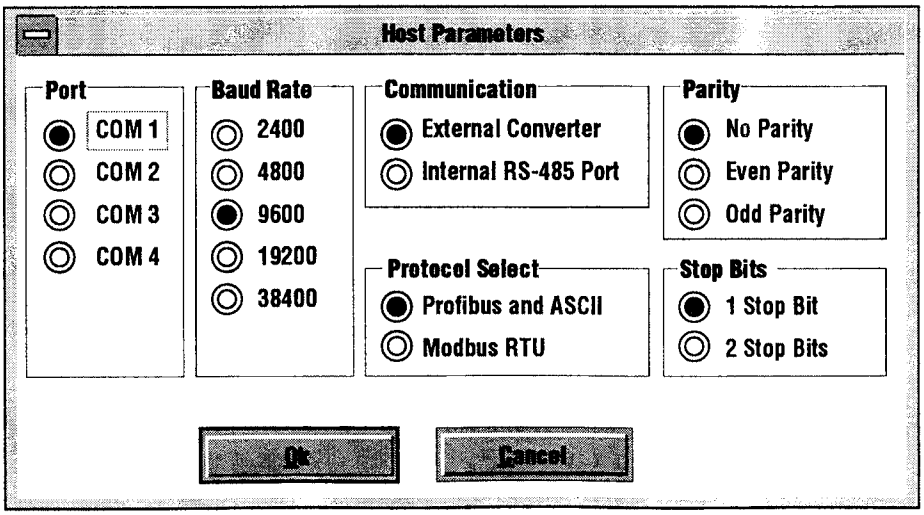
To change communications parameters:

1. **Go to the Main Configuration screen.**
2. **Click/Select the "Communication" pull-down menu.**
3. **Click/Select the "Host Parameters" item.**

   The "Host Parameters" dialog box appears. An example is shown in Figure 10.

(Explanation of how to change Communications Parameters continues...)

Figure 10. *Changing Host Communications Parameters*



(...continued from preceding page.)

4. **Click/Select the parameters that the Host is to use to configure the connected module. Typically, these are also the same parameters to be used in the module's eventual application.**

5. **Click/Select "Ok".**

   A "Warning" dialog box (see Figure 11) appears, indicating that the Host parameters are about to be changed from those of the connected module, and that their being different effectively "cuts off" communications.

6. **Click/Select:**

   "Ok" to continue (changes parameters and goes to the Main Configuration screen)

   "No" to cancel the entire procedure (cancels any changes and goes to the Main Configuration screen)

   "Cancel" to return to the "Host Parameters" dialog box.

7. **If continuing ("Ok" in Step 6), Click/Select the "Utilities" pull-down menu from the Main Configuration screen.**

8. **Choose the "Download" menu item, then the "Reprogram Module" sub-item.**

   This brings up a blank "Module Selection" dialog box as shown in Figure 12. The parameters chosen in Step 4 are shown along the bottom of the box under "Interface:".

9. **Click/Select an address to download to the connected module. (Changing the module Communications Address is also explained later, page 66).**

10. **Click/Select "Ok".**

11. **The warning message in Figure 13 appears, because the communications parameters changes made in Step 4 of this procedure effectively severed communications with the connected module.**

    Click/Select "Yes" to begin the process of re-establishing communications.

    The Configuration Program flashes a Synchronization screen with instructions to cycle power to the connected unit.

12. **Cycle power to the unit as instructed.**

    The "Reprogramming Files" selection box appears (see Figure 14).

13. **Click/Select the file for the protocol that was chosen in Step 4.**

14. **Click/Select "Ok".**

    The Configuration Program now begins a download of the new communications parameters to the connected module. A "Program Download" status bar is displayed during the process.

    When the operation is complete, the confirmation box shown in Figure 15 is shown, indicating a successful reprogramming.

15. **Click/Select "Ok" to return to the Main Configuration screen and continue with the module configuration process.**

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Figure 11. Warning of a Host Parameter Change

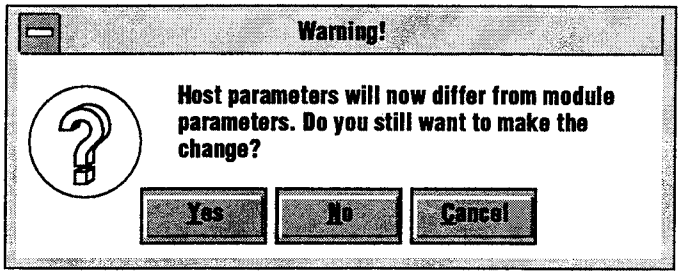


Figure 12. Choosing a Module for Downloading a New Protocol

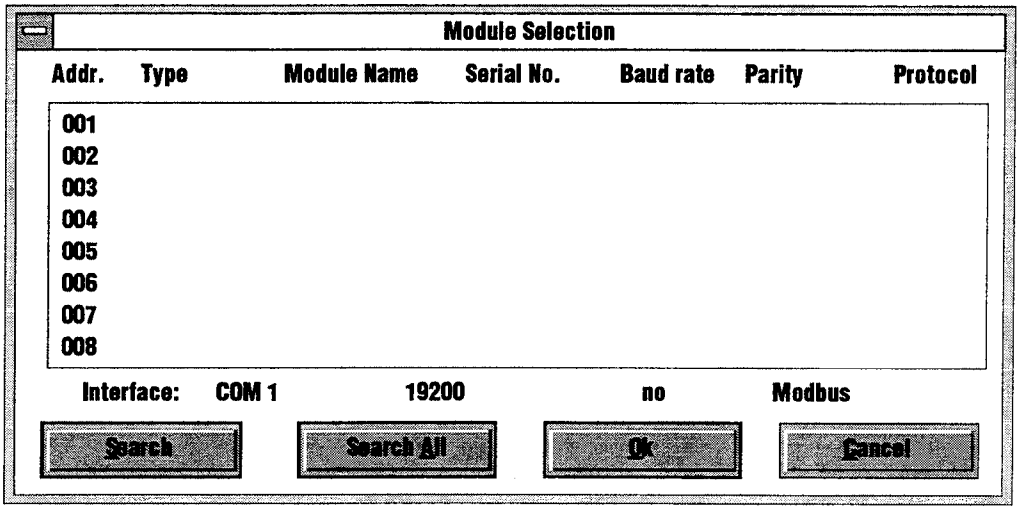


Figure 13. Indicating a Non-responsive Module

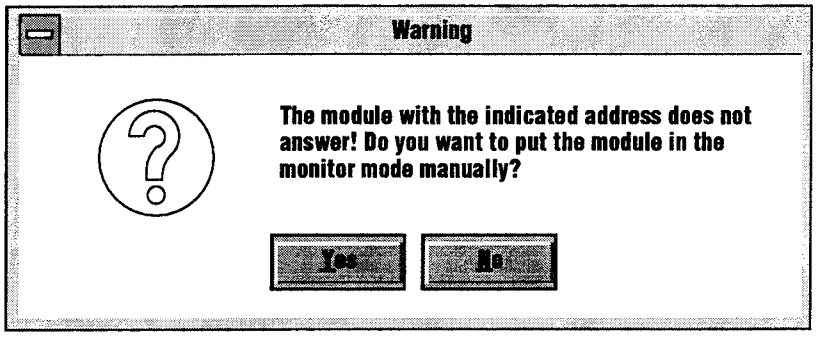


Figure 14. Selecting a Protocol for Downloading to a Module

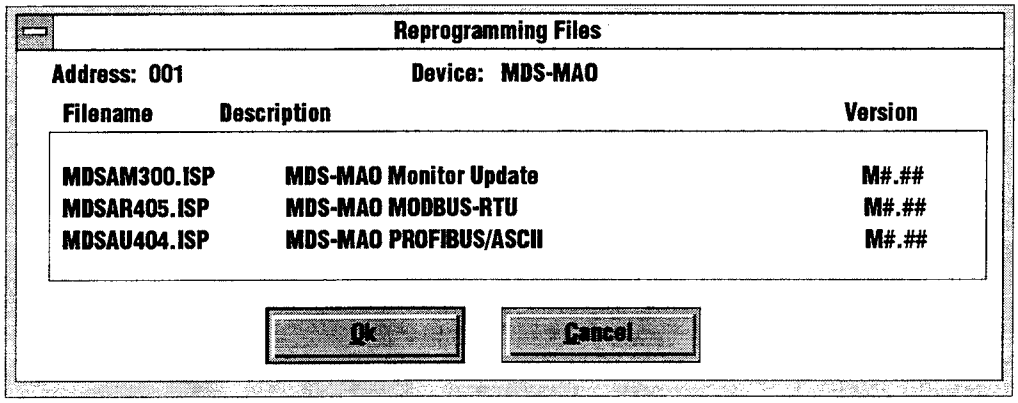
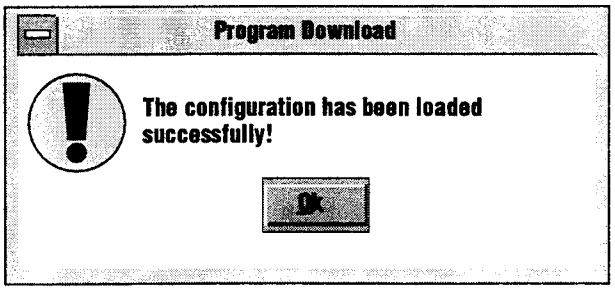


Figure 15. Confirming a Successful Reprogramming Download



Configuring MDS Modules — UPLOAD a Configuration File

Every MDS module is shipped with a Configuration File in its memory. Uploading this file before doing anything else accomplishes two things:

- It establishes communications between the Host and the connected module
- It opens a Configuration File

NOTE:
It is not necessary to have an MDS module connected to the Host to "build" a Configuration File. A file or files can be built and downloaded later.

Before uploading, set up the appropriate equipment as shown in either Figure 6 (page 16) or Figure 7 (page 17). Launch the Configuration Program as described on page 20, and with the Main Configuration screen up as shown in Figure 9:

1. **Pull down the "File" menu.**
2. **Click/Select "From Module" (see Figure 16a.)**

   The "Module Selection" dialog box will appear (Figure 16b.)
3. **If a Module is highlighted in the Module Selection dialog box, as shown in Figure 16b,**

   GO TO Step 6.

   If no modules show up in the dialog box, it is probably because the communications parameters of the Host do not match those of the connected module.

   The Host parameters are listed in the "Interface:..." field, as shown in Figure 16b.

(Explanation of the Uploading Procedure continues...)

Figure 16a. Uploading a Configuration File from a Connected MDS Module

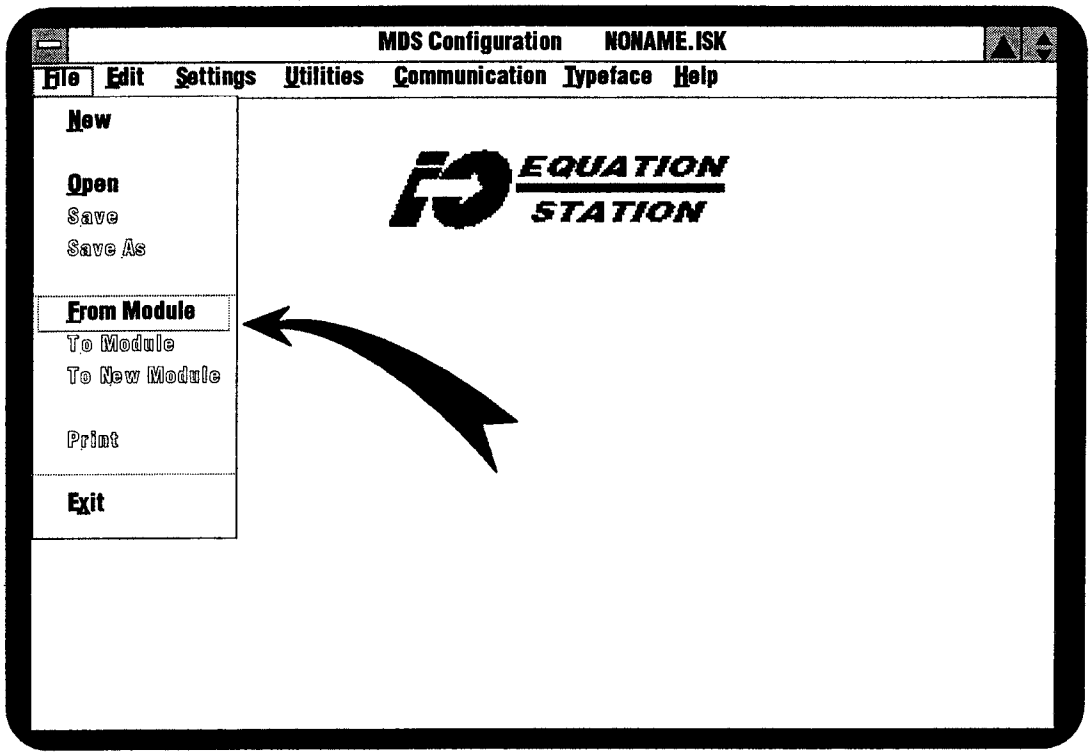
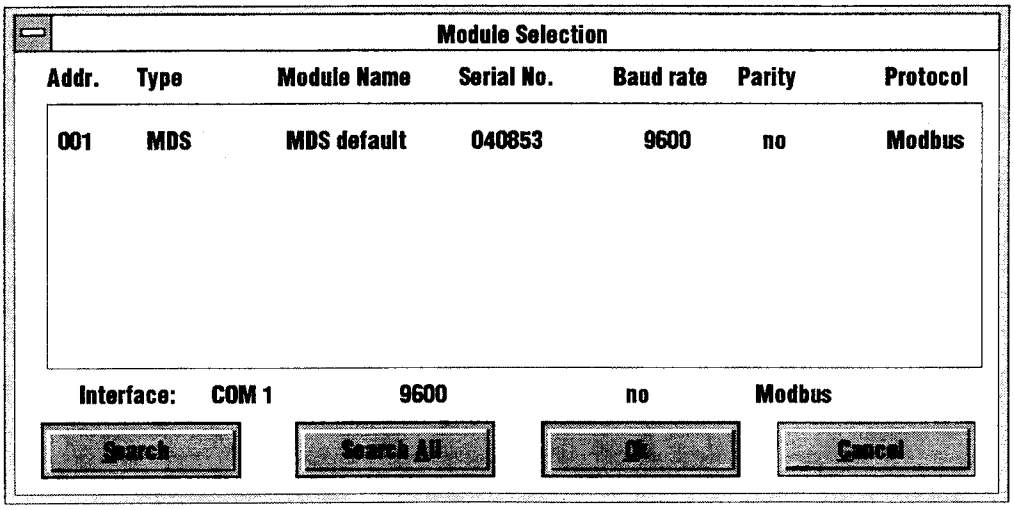


Figure 16b. Selecting a Module from which to Upload a Configuration File



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(...continued from preceding page.)

4. **Click/Select "Search All" as shown in Figure 16c.**

   This initiates a scan for the connected module using all of the communications settings combinations available in the Configuration Program (MODBUS, PROFIBUS, all baud rates, all parity settings, etc.) --It takes a while.

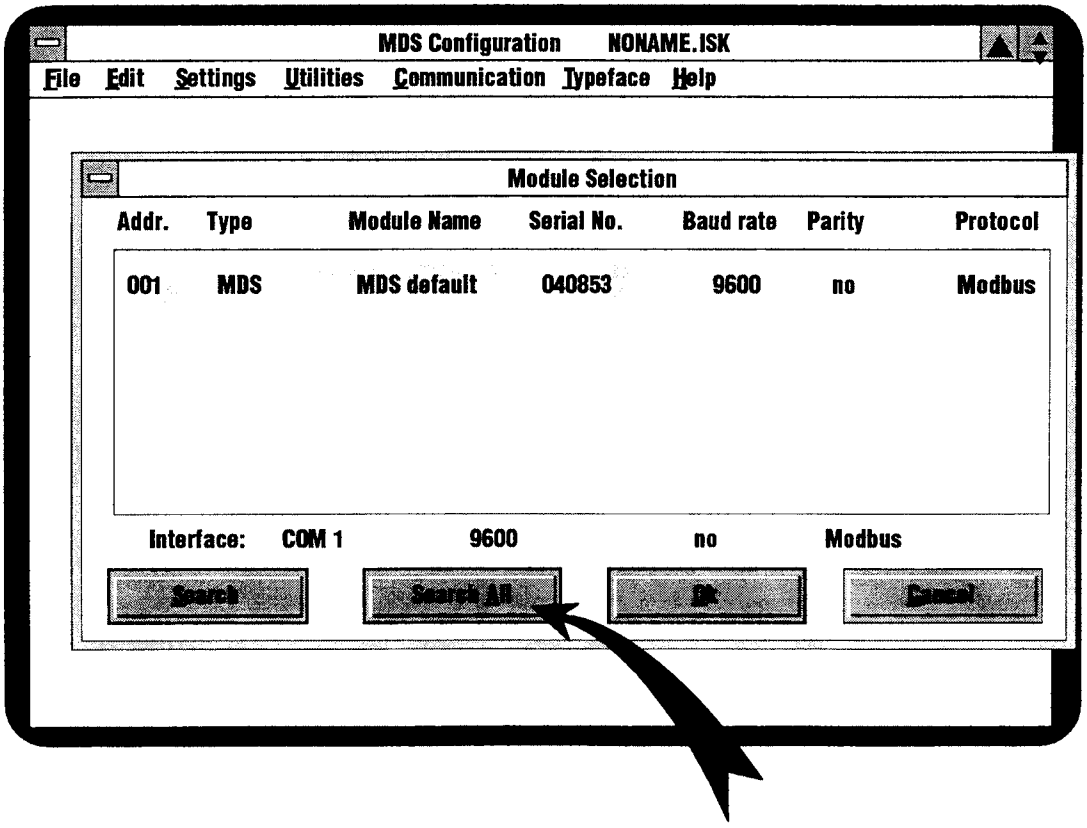
   When the connected module is found, its information appears in the dialog box.

5. **Once a Module is found in Step 4, Click/Select "Cancel" to stop the search. This saves time, since the "Search All" scan does not stop until all possible communications settings combinations have been exhausted, even after a module is found.**

6. **Click/Select "Ok" to establish communications with the connected module.**

IMPORTANT:
Clicking/Selecting "Ok" in Step 6
can change the communications parameters of the Host
(listed in the "Interface:..." field shown in Figure 16c).
Refer to page 22 for instructions on changing the communications parameters of the Host, or to page 66 for instructions on changing the module communications parameters.

16c. *Searching for Connected Modules*

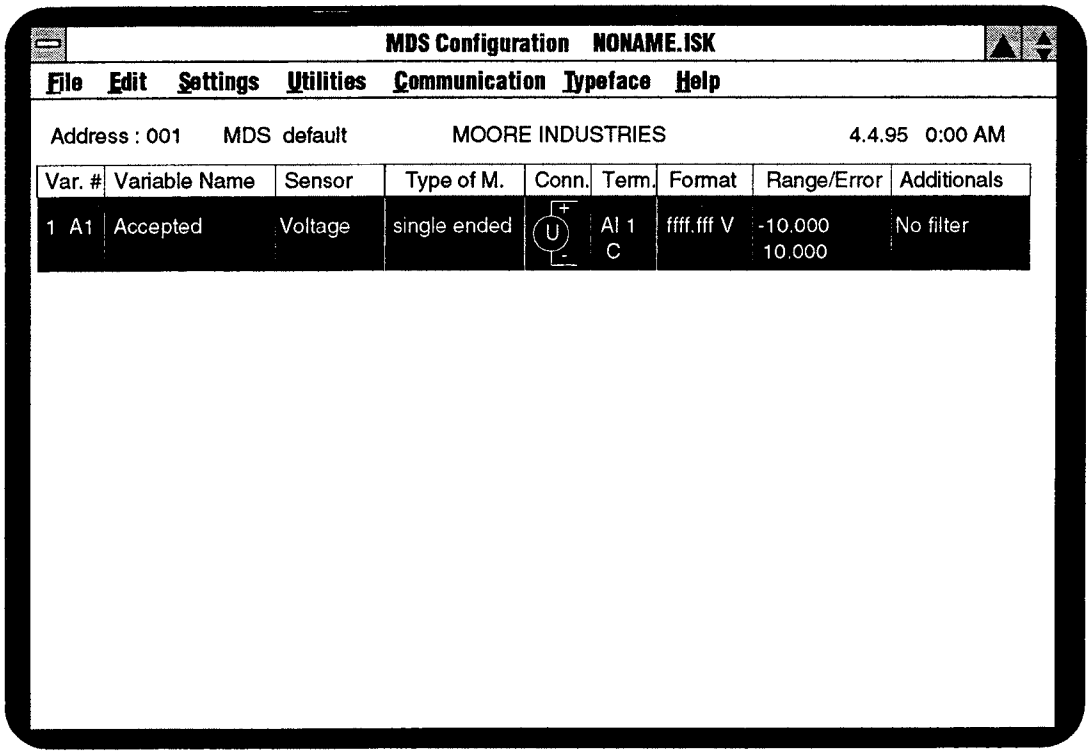


The main screen is now as shown in Figure 17. The fact that a variable has been successfully uploaded indicates that good communications exist between the Host and the connected module.

IMPORTANT:
The settings in the active Configuration file on the Main Configuration screen do not effect the operation of the connected module until they are downloaded.

The factory default name for the configuration file is "`noname.isk`". Some users prefer to save the working configuration file under a different name before doing any work. Instructions on saving the configuration file, refer to page 73.

Figure 17. *The Main Configuration Screen after Uploading the Standard Factory Default from an MDS Module*



Configuring MDS Modules — OPEN an Existing Configuration File/START a New Configuration

If desired, instead of uploading a Configuration File from a connected module, the user can open a file already on disk, or begin a new file.

IMPORTANT:
*Opening a Configuration File on disk or starting a new file affects only the information on the Host. It **DOES NOT** automatically establish communications between Host and connected module(s).*

Moore Industries suggests uploading the Configuration File from a module (page 26) in order to establish communications, then, if desired, performing the following procedure.

To Open an Existing Configuration File:

1. **Click/Select the "File" pull-down menu from the Main Configuration screen.**

2. **Click/Select the "Open" menu item.**

   The screen will show the "Open" dialog, similar to the one in Figure 18.

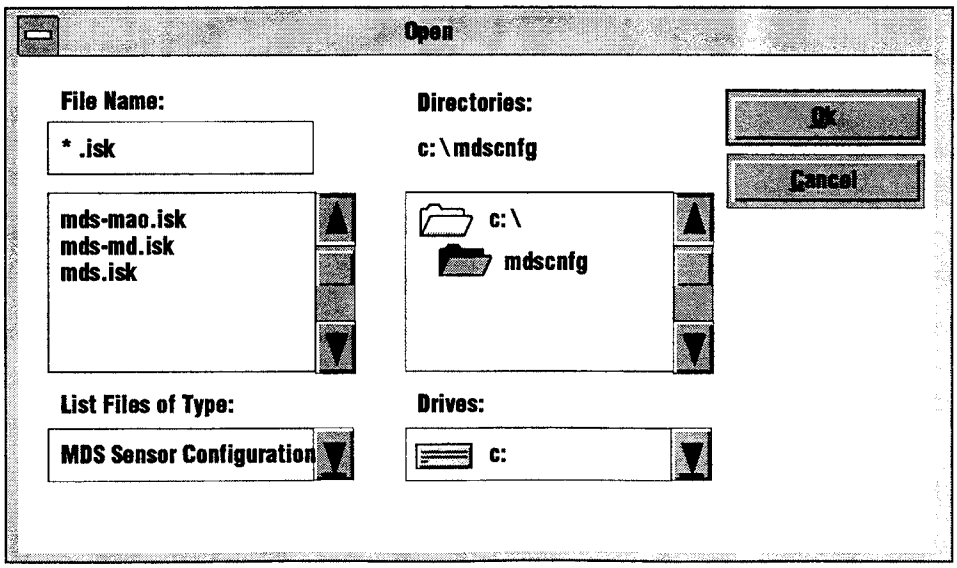
3. **Use the Windows conventions to specify the drive/directory/filename of the Configuration File to be opened.**

NOTE:
The default extension for MDS Configuration Filenames is ".isk".

4. **Click/Select "Ok" when the desired filename is shown in the "Open..." dialog box (Windows) to return to the Main Configuration screen. The parameters for the specified file will be showing.**

IMPORTANT:
Changes made to the file on the Main Configuration screen do not effect the operation of the connected module until the file is downloaded.

Figure 18. *Opening an Existing Configuration File*



The following files are copied to the hard disk when the Configuration Program is installed:

- `mds.isk` - The standard module factory demonstration Configuration File
- `mds-md.isk` - The factory demonstration Configuration File for MD-equipped MDS modules
- `mds-mao.isk` - The factory demonstration Configuration File for MAO-equipped MDS modules

Any of these files can be opened (brought up on the Main Configuration screen), modified (or not), and subsequently downloaded, provided the module has the options required, and that communications between Host and module have been established.

NOTE:
It is not possible to download an option-equipped Configuration File to an MDS module unless it is equipped with that option. That is, you cannot download "`mds-mao.isk`" to an MDS module that is not equipped with the -MAO option.

To Start a New Configuration File:

1. **Click/Select the "`File`" pull-down menu on the Main Configuration screen.**
2. **Click/Select the "`New`" item.**

   The "`Device Selection`" dialog box prompts for the type of MDS module that is to be the eventual destination for the Configuration File.

   Refer to the descriptions of the three available module types on page 2.
3. **Click/Select the appropriate module type.**
4. **Click/Select "`Ok`" to return to the Main Configuration screen.**

IMPORTANT:
*Starting a new Configuration File affects only the information on the Host. It **DOES NOT** automatically establish communications between Host and connected module(s).*

Moore Industries suggests uploading the Configuration File from a module (page 26) in order to establish communications, then, if desired, performing the procedure to start a new file.

NOTES:
It is not possible to download an option-equipped Configuration File to an MDS module unless it is equipped with that option. That is, you cannot download "`mds-mao.isk`" to a standard MDS module.

Changes made to the file on the Main Configuration screen do not effect the operation of the connected module until the file is downloaded.

Configuring MDS Modules — SET Module Name and User Name

The screen in Figure 19 points out the fields for the default module and user names for the factory default Configuration File of a standard MDS module (no options).

"`MDS default`" is the default module name, and "`MOORE INDUSTRIES`" is the default user.

To change either of these fields, Click/ Select the existing name on the screen, and enter the desired alpha-numeric name for the intended application in the dialog box that appears.

Alternatively, pull down the "`Settings`" menu on the main screen, and Click/ Select "`Module Name`" or "`User Name`".

A Module Name may contain up to 20 characters.

A User Name may contain up to 24 characters.

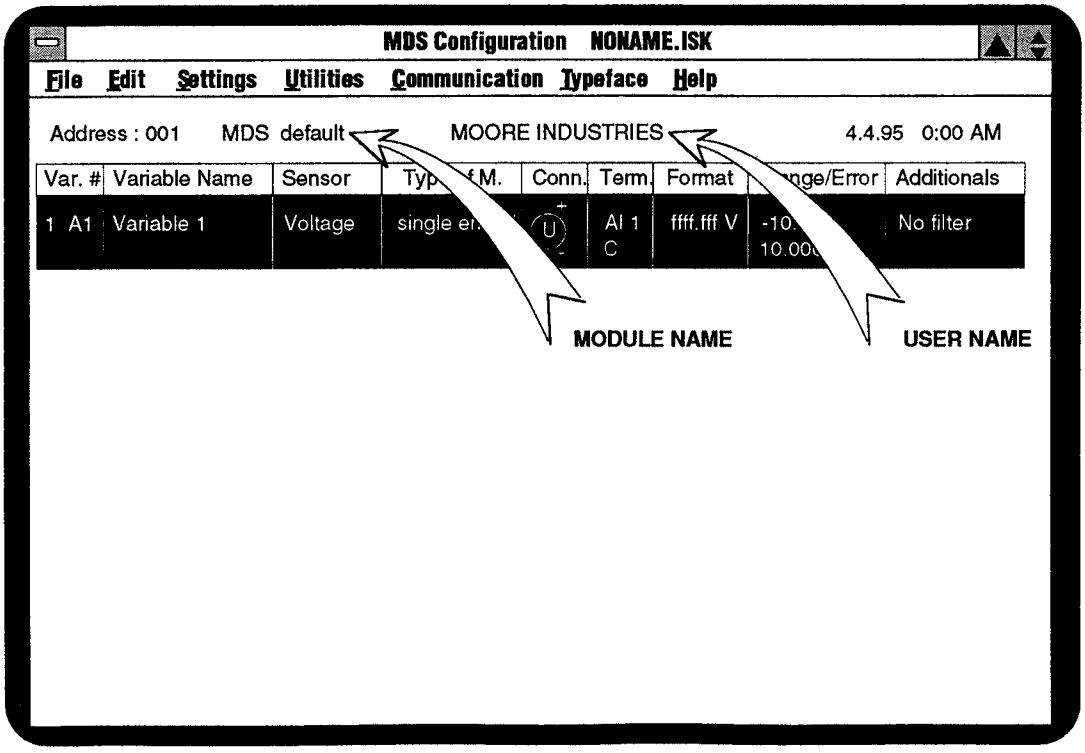
NOTES:
Module and User Names are stored in unit memory after the Configuration File is downloaded.

Modules within a system may share Module and/or User names, but ***not addresses****.*

IMPORTANT:
Adding, modifying, and/or deleting variables ***DOES NOT*** *effect the settings in the connected module until a successful download has been executed (page 72).*

Quitting the Configuration Program before downloading and/or saving the Configuration File will result in loss of the configuration data displayed on the Main Configuration screen.

Figure 19. *Changing Module Name and/or User Name*



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EQUATION STATION

Configuring MDS Modules — DELETE or ADD Variables

Variables are the building blocks used to construct a Configuration File. Each contains all of the settings that control the function of a single channel on a module.

To DELETE a Variable:

NOTE:
In the display of a Configuration File, one variable is always highlighted.

1. **Click/Select (or use the cursor keys) to highlight the variable that is to be deleted.**
2. **Pull down the "Edit" menu, and Click/Select "Cut Variable".**

   OR

   Press <SHIFT> and <DELETE>.

IMPORTANT:
*When variables are deleted, the connection schemes of any succeeding variables can change. The display of the "Var. #", "Conn.", and "Term." parameters of succeeding variables will **SHIFT** to fill any void.*

See "NOTES" in Figure 20.
"Variable Name" and "Type of M." do not change.

NOTE:
When a variable is deleted, the display of all other alarm, math, process-controlled output, pulse-width modulated output, and analog output variables in that Configuration File change color to indicate an error.

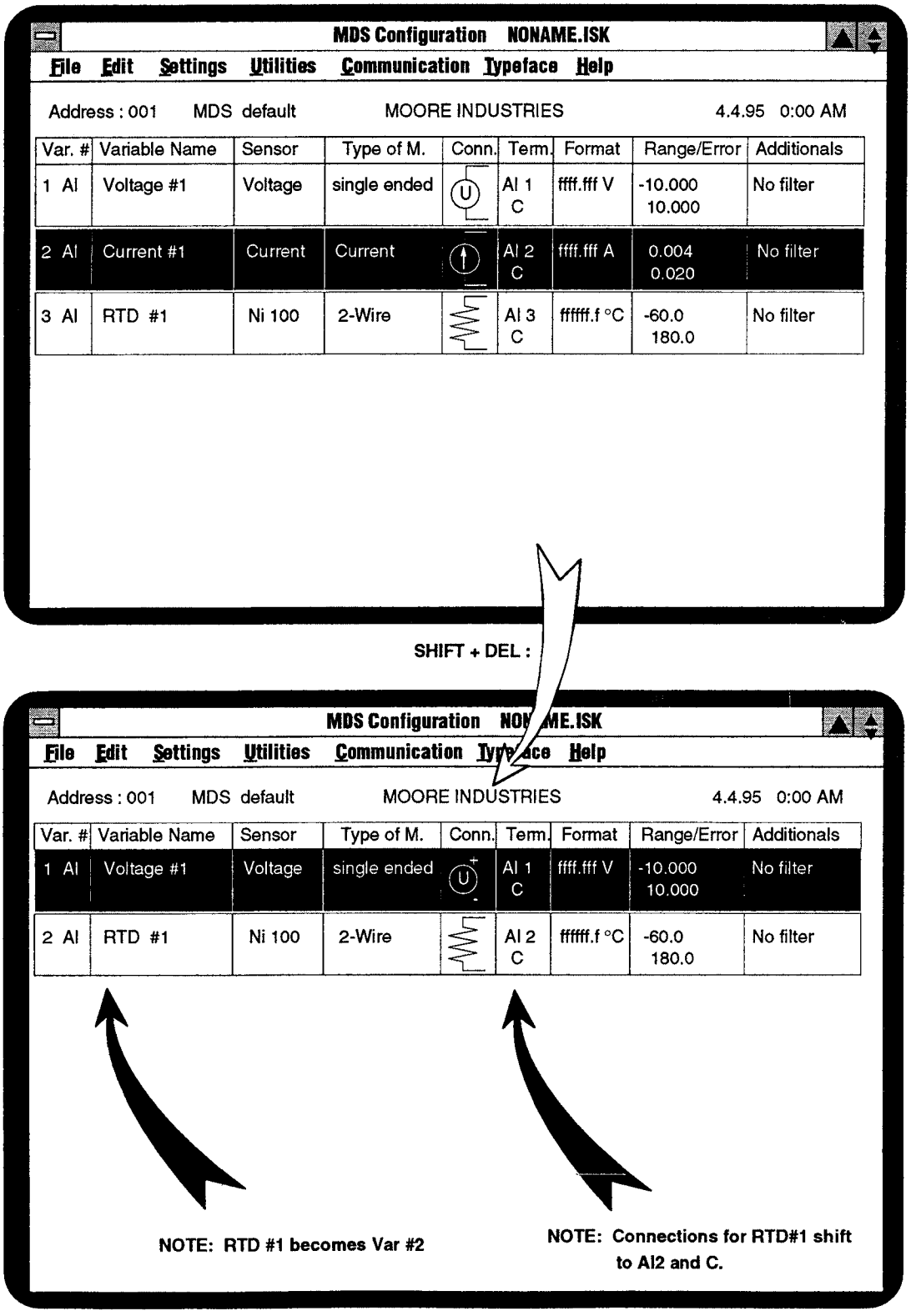
Source variable designations must be verified in order to clear any error flag(s).

3. **Click/Select (or use the cursor keys) to highlight any variable whose display in the Configuration File is shaded or colored.**
4. **Click/Select the "Additionals" field of the highlighted variable (or pull down the "Settings" menu and Click/Select the "Additionals" item).**
5. **Verify that the designated source variable is still valid. Click/Select a new, valid source variable if the old one was deleted in Step 2.**
6. **Click/Select "Ok" to return to the Main Configuration screen.**

IMPORTANT:
*Adding, modifying, and/or deleting variables **DOES NOT** effect the settings in the connected module's memory until a successful download has been executed. (page 72)*

Quitting the Configuration Program before downloading and/or saving the Configuration File will result in loss of the configuration data displayed on the Main Configuration screen.

Figure 20. Deleting a Variable — Subsequent Variables Shift and Flag Source Variable Designation Errors



To ADD a Variable:

NOTE:
In the display of a Configuration File, one variable is always highlighted.

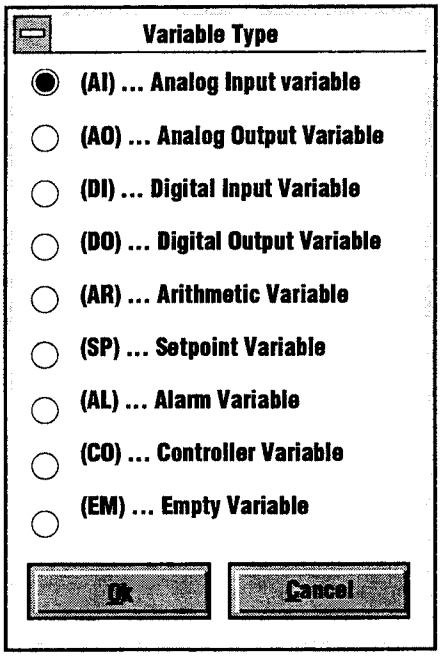
1. **From the Main Configuration screen, press F2.**

   OR

   Pull down the "Edit" menu on the main screen and Click/Select "New Variable".

   The "Variable Type" selection box pops up. Figure 21 shows the box.

Figure 21. Selecting Variable Type



2. **Refer to the "*Configuration Limits*" section, immediately following this procedure, for information on setting up combinations of I/O channels and other types of variables in a Configuration File.**

3. **Click/Select the type of variable that is to be added.**

NOTE:
"Analog Output" is available only with the -MAO option (refer to page 3).

IMPORTANT HINT:
Alarm, Process-controlled, Pulse-width Modulated, Arithmetic, and Analog Output variables require the designation of at least one other variable in the Configuration File as a source.

*It is easier to add all source variables **FIRST**, and to add Alarms, Process-controlled Digital Outputs, Pulse-width Modulated Outputs, Arithmetic variables, and Analog Output variables **AFTER** their sources are "above" them in the Configuration File.*

NOTE:
Once added, it is not possible to change variable type.

An analog input variable, for example, cannot be changed to a digital output.

If a variable is added incorrectly, it must be deleted, and the correct variable must be added.

4. **When the desired type of Variable is selected, Click/Select "Ok" to return to the Main Configuration screen. The selected variable will have been added to the end of the Configuration File and will be highlighted (it may also be displayed in color if it requires a source variable designation or formula).**

Combinations of Variables

As variables are added or deleted from an active Configuration File, the Configuration Program tracks the number of channels used, and the number of channels available, and flashes an error message if any "illegal" configuration attempt is made (Click/Select "Ok" to clear the error).

The ***maximum total*** number of channels — input, output, alarm, arithmetic, setpoint, or empty — that a standard MDS module can accommodate is 8; for modules equipped with the -MD or -MAO option, the ***maximum total*** number is 12.

Any combination of variables can be put together in a Configuration File (and downloaded to a module) as long as long as the total number of channels used by all the variables is less than or equal to the rated ***maximum total***.

Table 3 lists the number of channels used by each type of variable. To determine how many channels are being used in a Configuration File, total the channel usage number for each of the variables in the file.

(Examples of how to use Table 3 to "build" a Configuration File are presented on the following page.)

Table 3. *Variable and I/O Type vs. Channels Required*

Variable Type	Channel Usage per Variable	Maximum Usage Possible, Standard MDS	Maximum Usage Possible, MDS w/-MD	Maximum Usage Possible, MDS w/-MAO
Current IN (Analog IN)	1	4	4	4
Single-ended Voltage (Analog IN)	1	4	4	4
Differential Voltage (Analog IN)	2	2	2	2
RTD, 2-Wire (Analog IN)	1	4	4	4
RTD, 3-Wire (Analog IN)	2	2	2	2
RTD, 4-Wire (Analog IN)	3	1	1	1
TC w/Internal Compensation (Analog IN$_1$)	1	3(2)	3(2)	3(2)
TC w/External Compensation (Analog IN$_1$)	1	4	4	4
Bridge, 4-Wire (Analog IN)	2	2	2	2
Bridge, 6-Wire (Analog IN)	4	1	1	1
Potentiometer (Analog IN)	1	4	4	4
Hi/Lo Status (Digital IN)	1	2	4	2
Frequency (Digital IN)	1	2	2	2
Cumulative Counter (Digital IN)	1	2	2	2
Up/Down Counter (Digital IN)	2	1	1	1
Quadrature Counter (Digital IN)	2	1	2	1
Host Controlled (Digital OUT)	1	2	4	2
Process Controlled (Digital OUT)	1	2	4	2
Pulse Width Modulation (Digital OUT)	1	2	2	2
Current Out (Analog OUT)	2	0	0	1
Arithmetic	1	8	12	12
Alarm	1	8	12	12
Setpoint	1	8	12	12
Empty	1	8	8	12

1 Thermocouple Inputs cannot be used with Current (A, mA) inputs in the same MDS Module.
2 -ICJ Option REQUIRED.

NOTE: The Configuration Program signals the user when any "illegal" I/O combination of variables is attempted.

(Configuration Limits...continued)

Example: A Configuration File for a standard MDS module might be configured as follows:

- 2 three-wire RTD input variables
- 1 Arithmetic variable
- 2 Alarm variables
- 1 Process-controlled output variable

Table 3 shows that:

- Each RTD input variable uses 2 channels
- The arithmetic variable uses 1 channel
- Each alarm variable uses 1 channel
- The process-controlled output uses 1 channel

(2 RTDs X 2 channels) + (1 math X 1 channel) + (2 alarms X 1 channel) + (1 output X 1 channel) =

8 channels

In this example, attempting to add any variables would cause the Configuration Program to return an error.

To add variables to this configuration, or to change one of the variables to a type that uses more channels, one of the existing variables would first have to be deleted to free up channel(s).

In another example, a Configuration File with a 6-wire Bridge analog input variable cannot accommodate any other analog input variables because according to Table 3, all of its channels would be "used up" by that one, 6-wire Bridge. Changing the Bridge type from 6-wire to 4-wire (refer to page 44), would free up 2 input channels.

Shaded or Colored Variables Display

When Arithmetic, Alarm, or Analog Output variables are added to a Configuration File, their appearance on the screen is in colored or shaded text. This is to indicate that some of the variable's parameters must be set or checked in order to function properly.

Also, if a variable has been designated as the source for an alarm, arithmetic, or analog output variable, and it is deleted from the active Configuration File, the dependent variable or variables change color.

NOTE:
It is not possible to change variable type; that is, from input to output, from alarm to setpoint, etc.

If an incorrect variable is inadvertently added, delete it and add the new, correct variable (refer to page 34).

Configuring MDS Modules — MODIFY Variable Parameters

With the exception of an Empty variable, all of the variables in a Configuration File, regardless of type, have parameters that can be modified by the user.

Alarm variables, for example, should be set up to work with other variables in the Configuration File in order to generate their output. Likewise, arithmetic variables can be based on the state or level of one or more of the other variables, or they can simply generate numeric constants for use by other variables in the Configuration File.

The following variable parameters are displayed in fields on the Main Configuration screen:

- Var.# (Variable Number)
- Variable Name
- Sensor
- Type of M. (Type of Measurement)
- Format (Engineering units, conversion, display)
- Range/Error (Range and Error Handling)
- Additionals (Filtering, formulae, miscellaneous)

Not all of these parameters can be modified, depending upon the variable type. It is not possible, for example, to modify the "Sensor" field of either a digital input or output variable.

It is also impossible to change from one variable type to another. That is, a variable cannot be changed from input to output, or from alarm to setpoint, etc.

If an incorrect variable is inadvertently added, delete it and add the new, correct variable (refer to page 34).

To set any of the parameters that *can* be modified:

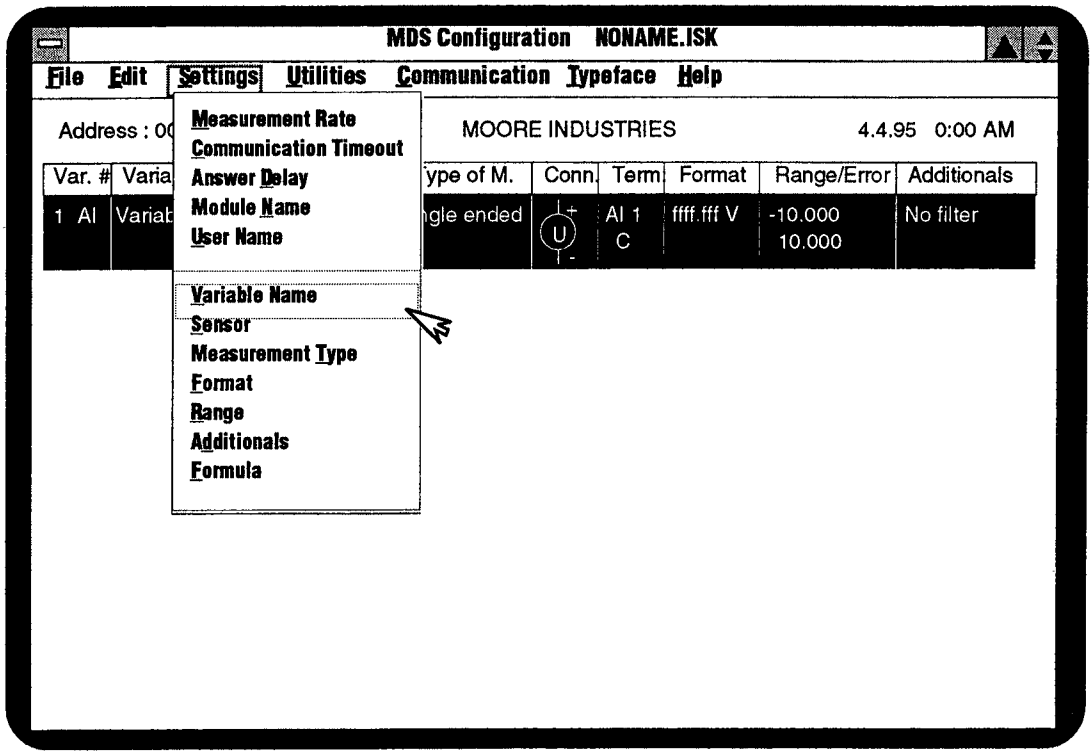
1. **Go to the Main Configuration screen.**
2. **Click/Select, or use the cursor movement keys to highlight the variable.**
3. **Click/Select the field in the highlighted variable that is to be modified**

   OR

   Pull down the "Settings" menu, as shown in Figure 22, and Click/Select the parameter that is to be modified from the list.

The sections following Figure 22 explain how to modify each of the variable parameters individually.

Figure 22. Modifying Variable Parameters



Modifying Variables — "Var.#" Variable Number

This field/parameter reflects the order in which a variable is added to the Configuration File. It also gives a 2-letter digraph indicating variable type:

- AI for Analog Input
- AO for Analog Output
- DI for Digital Input
- DO for Digital Output
- AR for Arithmetic calculation
- SP for Setpoint
- AL for Alarm
- EM for Empty

To change a variable number, delete one of the variables that precede it in the Configuration File. Refer to page 34 for instructions.

NOTE:
When a variable is deleted, the variable numbers of succeeding variables in the Configuration File are decreased by 1.

The connections for succeeding variables may also change, depending upon variable type (refer to page 35).

The variable type, name, sensor selection, etc. ***DO NOT*** *change.*

Modifying Variables — "Variable Name"

This field/parameter is a user-set identification tag for the highlighted variable. When variables are added, the Configuration Program assigns them a default name reflecting the order in which they were added to the Configuration File.

To modify the variable name:

1. **Click/Select or use the cursor movement keys to highlight the variable whose name is to be changed.**
2. **Click/Select the "Variable Name" field of the highlighted variable, or pull down the "Settings" menu on the main screen and Click/Select "Variable Name".**
3. **Enter the new name in the box that appears, a maximum of 20 alphanumeric characters will be stored in module memory after downloading.**

Modifying Variables — "Sensor"

NOTE:
This field/parameter is only active in Analog Input variables.

This field sets the type of analog input sensor to be processed by the highlighted variable. When an Analog Input variable is added to a Configuration File, the Configuration Program automatically sets it to a default sensor configuration; namely, 0.004-0.020 Amps.

When changing from this default, the user chooses from a database of sensor types that are installed on the Host hard disk when the Configuration Program is installed.

To select Sensor Type:

1. **Click/Select, or use the cursor movement keys to highlight the Analog Input variable whose sensor type is to be set.**
2. **Click/Select the "Sensor" field of the highlighted variable**

   OR

   Pull down the "Settings" menu on the Main Configuration screen, and choose the "Sensor" item, then choose the "Selection" item from the sub-menu.

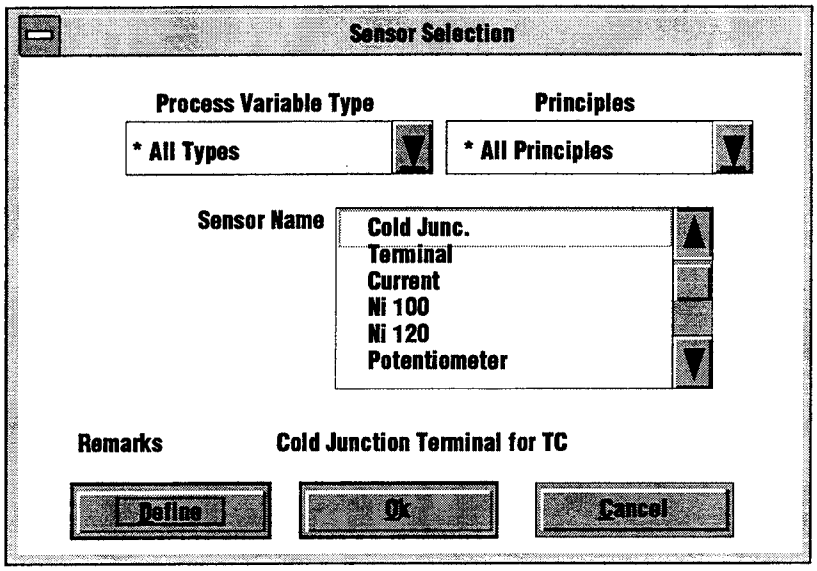
   The "Sensor Selection" dialog box, shown in Figure 23, will appear.

NOTE:
When "Sensor" is chosen from the "Settings" pull-down menu, the user is given a choice of the following sub-menus:

- "Selection" - The "Sensor Selection" box shown in Figure 23
- "Information" - Lists the Principal, Type, Name, date of any change, and any information on customization performed on the sensor in the highlighted variable
- "Linearization" - Gives information on any linearization being carried out by the sensor in the highlighted variable
- "Calibration" - Downloads the active Configuration File and displays a dialog box that allows the user to apply actual analog input to a module, and to enter values in the dialog box for offset and scaling to tune the readings for the channel.

(The Sensor selection procedure continues...)

Figure 23. Selecting a Sensor for an Analog Input Variable



(...continued from preceding page.)

3. **Refer to the sections following this procedure for detailed explanations of each of the fields and menus in the "Sensor Selection" dialog box.**

4. **Click/Select the "Process Variable Type" pull-down list, and highlight "*All Types".**

5. **Click/Select the "Principles" pull-down list, and highlight "*All Principles".**

   All of the types of sensors that can be used with analog input variables are now shown in the "Sensor Name" scroll box (see Figure 23).

6. **Click on the scroll bar until the desired sensor is shown in the "Sensor Name" box, then Click/Select or use the cursor movement keys to highlight that sensor.**

7. **Click/Select "Ok" to return to the Main Configuration screen.**

   The newly selected sensor will be displayed in the "Sensor" field of the highlighted variable.

The Sensor Selection Dialog Box — "Process Variable Type"

This is a list of applications that typically make use of an analog input. The selection here works with the selection in the "**Principles**" pull-down to limit the listing of Sensors in the "**Sensor Name**" scroll box, acting as a sort of filter for the Configuration Program's Sensor Database.

The available Process Variable Types are:

- Acceleration
- Angle
- Current
- Distance
- Frequency
- Humidity
- Incliniation
- Length
- Lightness (photo intensity)
- Number of Pieces
- Number of Pulses
- Power
- Pressure, (Absolute)
- Pressure, (Differential)
- Resistance
- Temperature
- Thickness
- Time
- Torque
- User Defined
- Velocity
- Voltage
- Weight

The Sensor Selection Dialog Box — "Principles"

This is a list of analog input types from the Configuration Program's Sensor database. The selection here works with the selection in the "**Process Variable Type**" pull-down to limit the listing of Sensors in the "**Sensor Name**" scroll box, acting as a sort of filter for the Sensor Database.

The available Principle Input Sensor types are:

- Current
- Bridge
- Resistance
- Voltage
- Potentiometer
- Thermocouple

EQUATION STATION

Modifying Variables — "Type of M." Type of Measurement

This field sets the connection type of the highlighted variable.

The choices available depend upon the type of variable; analog input, digital input, or digital output.

To set "Type of Measurement":

From the Main Configuration screen,

1. **Click/Select or use the cursor movement keys to highlight the variable whose "Type of Measurement" parameter is to be set.**

2. **Click/Select the "Type of Measurement" field of the highlighted variable,**

   OR

   Pull down the "Settings" menu and choose the "Measurement Type" item.

   Depending upon the variable, the "Type of Digital Input/Output" or the "Type of Measurement" selection box will appear.

3. **Click/Select or use the cursor movement keys to select the configuration appropriate for the intended application.**

   NOTE:
   Some variable types accommodate only one configuration.

4. **Click/Select "Ok" to return to the Main Configuration screen.**

   The highlighted variable will reflect the selection.

   NOTE:
   The "Type of Measurement" selection has, in some cases, a direct effect on the number of channels used by a variable.
   Refer to Table 3, page 37.

   If changes are made in "Type of Measurement", take note of any corresponding changes in the "Conn." and "Term." fields of the highlighted variable.

Modifying Variables — "Format"

This field sets engineering units, including scale and offset; length of field; and decimal point position in the readback of an analog input or analog output variable (analog output requires -MAO option).

To set "Format", go to the Main Configuration screen:

1. **Click/Select or use the cursor movement keys to highlight the variable whose "Format" field is to be set.**

2. **Click/Select the "Format" field of the highlighted variable,**

   OR

   Click/Select "Format" from the "Settings" pull-down menu.

   The Format dialog box appears, as shown in Figure 24.

3. **Pull down the list for the "Unit" entry field, and Click/Select the appropriate engineering unit value to be returned by the variable when queried during operation,**

   OR

   Click/Select the "Unit" field, and enter a custom engineering unit (5 characters, max).

4. **Click/Select "Conversion".**

   The "Unit Conversion" dialog box will appear. See Figure 25.

(Explanation of the "Format" dialog box continues...)

Figure 24. Setting Engineering Units with the Format Dialog Box

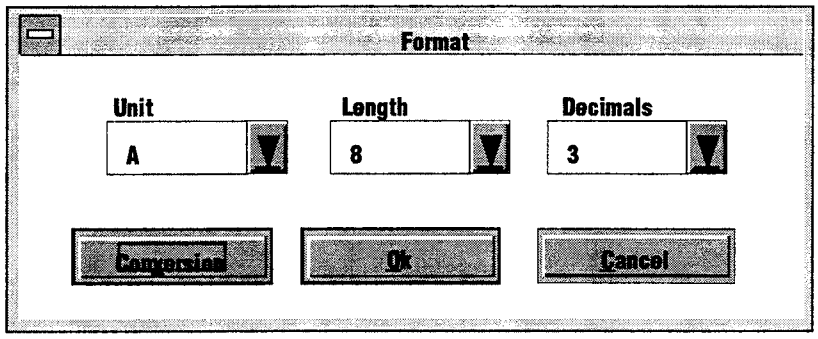
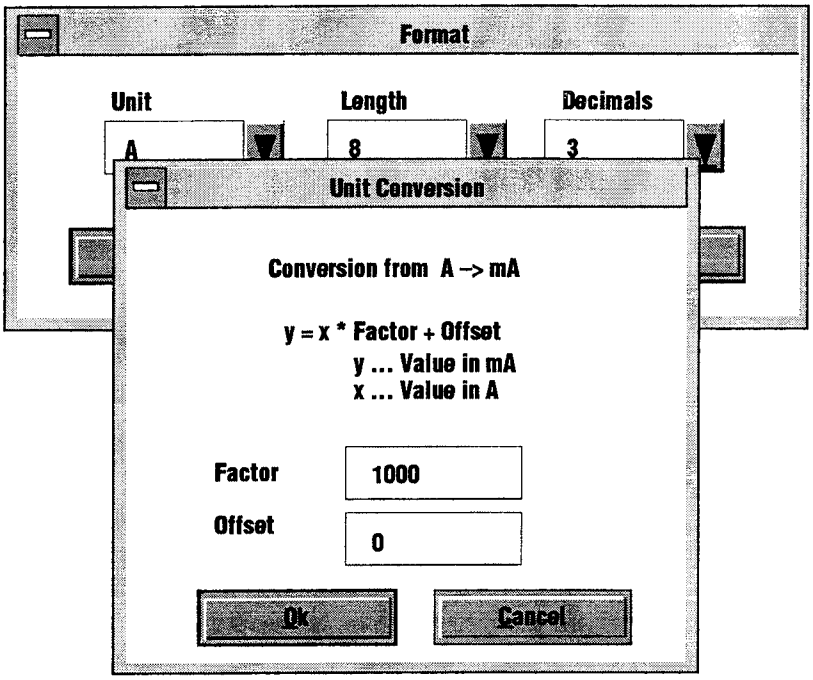


Figure 25. Converting Engineering Units in the Format Field of a Variable



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4a. Use the formula shown in the dialog box, if necessary, to apply the entered engineering units to the variable.

Note that:
- **current input/output default is A**
- **temperature input default is °C**
- **resistance input default is °C**
- **voltage input default is V**
- **bridge input default is V/V**

All conversions are based on these defaults (they are the "x" value in the equation y=mx+b)

4b. Click/Select "Ok" to return to the "Format" dialog box.

5. Click/Select "Ok" to return to the Main Configuration screen,

OR

Click/Select the "Length" field to set the number of characters, 1 to 8, to be returned by the variable when queried during operation.

6. Click/Select "Ok" to return to the Main Configuration screen,

OR

Click/Select the "Decimals" field to set the number of places to the right of the decimal point, 0 to 6, to be returned by the variable when queried during operation.

7. **Click/Select "Ok" to return to the Main Configuration screen.**

   The "Format" field in the highlighted variable will reflect (with ffff's) the result of the entered configuration.

IMPORTANT:
Make a note of the settings in the "Length" and "Decimals" fields. They are used in formatting queries in both MODBUS RTU or PROFIBUS commands. Refer to the documentation for the application software being used for more information.

EXAMPLE - Converting Amps Input to % of Scale
Assume an application calls for an MDS module variable to process 4-20mA input as a proportionate range from 0 to 100%. To set the "Format" field of the variable:

1. **Highlight a default current input variable.**
2. **Click "Format".**
3. **Enter "%" (or its equivalent) in the "Unit" field of the dialog box.**
4. **Click/Select "Conversion".**
5. **Solve the equation. Remember that "Factor" equals Y1-Y2 over X1-X2.**

   The result is a factor of 6250; offset of -25.
6. **Enter the values and Click/Select "Ok".**
7. **Click/Select "Ok".**

   The variable on the Main Configuration screen should look like the one shown in Figure 26.

NOTES:
"Offset" programming in the "Unit Conversion" dialog box incorporates any entered "Factor"

*Adding, modifying, and/or deleting variables from the Main Configuration screen **DOES NOT** effect the settings in EEPROM of the connected (addressed) module until a successful configuration download has been executed. (page 72).*

Quitting the Configuration Program before downloading and/or saving the Configuration File will result in loss of the configuration data in the work area of the Main Configuration screen.

Figure 26. *Using the "Format" Parameter to set 4-20mA to read 0-100%*

Var. #	Variable Name	Sensor	Type of M.	Conn.	Term.	Format	Range/Error	Additionals
1 A1	Variable 1	Current	Current		AI 1 C	ffff.fff %	0.000 100.000	No filter

Modifying Variables — "Range/Error"

The parameters that are set in this field depend upon the type of variable being modified.

To configure "Range/Error", start at the Main Configuration screen:

1. **Click/Select or use the cursor movement keys to highlight the variable whose "Range/Error" field is to modified.**

2. **Click/Select the "Range/Error" field of the highlighted variable,**

   OR

   Click/Select "Range" from the "Settings" pull-down menu.

3. **For Analog Input variables, GO TO Step 5, page 50.**

   For Digital Input variables, GO TO Step 6, page 51.

   For Digital Output variables, GO TO Step 7, page 52.

   For Arithmetic variables, GO TO Step 8, page 53.

   For Setpoint variables, GO TO Step 9, page 54.

   For Analog Output variables (-MAO option required), continue with Step 4.

4. **Figure 27 shows the dialog box for configuring the Analog Output Range of the current output variable on an MDS-MAO.**

   The "Scaling" values boxes associate the input level of a source variable (which is designated in the "Additionals" field, refer to page 55) with the output.

   "Out of Range Response" specifies the "safe" values to which the output will go in the event the source variable (designated in the "Additionals" field, page 55) falls outside the range specified in "Scaling".

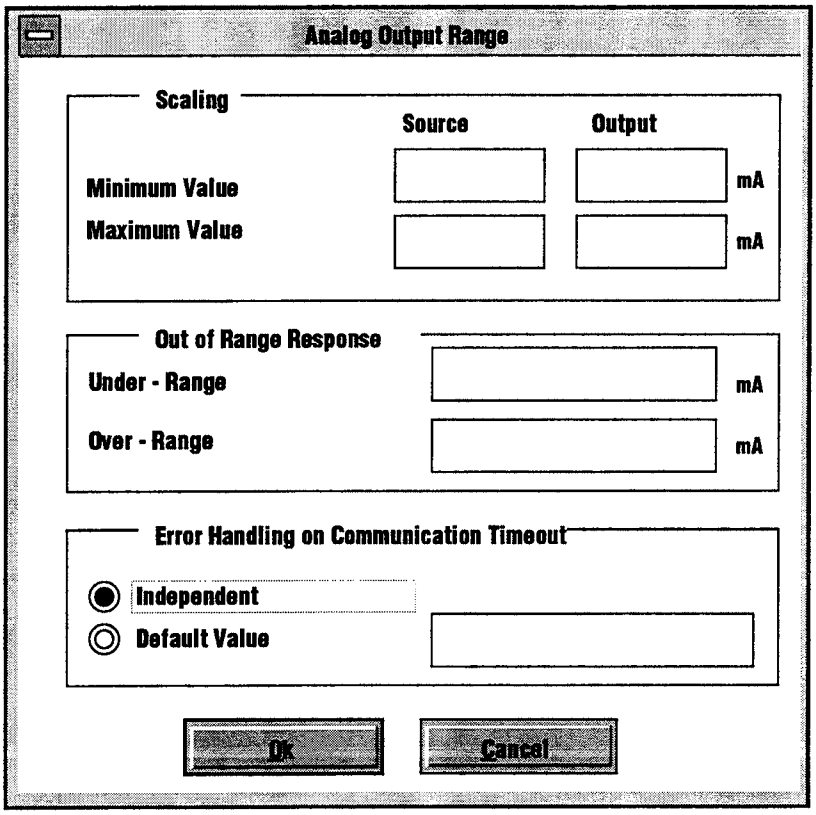
   The "Error Handling on Communications Timeout" selections permit the user to specify that the variable ignores a communications timeout ("Independent"), or that it goes to a specified level/value ("Default Value").

   4a. Click/Select and/or Enter the appropriate settings for the variable.

   4b. Click/Select "Ok" to accept the parameters and return to the Main Configuration screen.

(Explanation of the "Range/Error" parameter continues...)

Figure 27. Configuring the "`Range/Error`" Field of an Analog Output Variable (-MAO Option required)



EQUATION STATION

(...continued from page 48)

5. Figure 28 shows the dialog box for configuring the "Range" of an Analog Input variable.

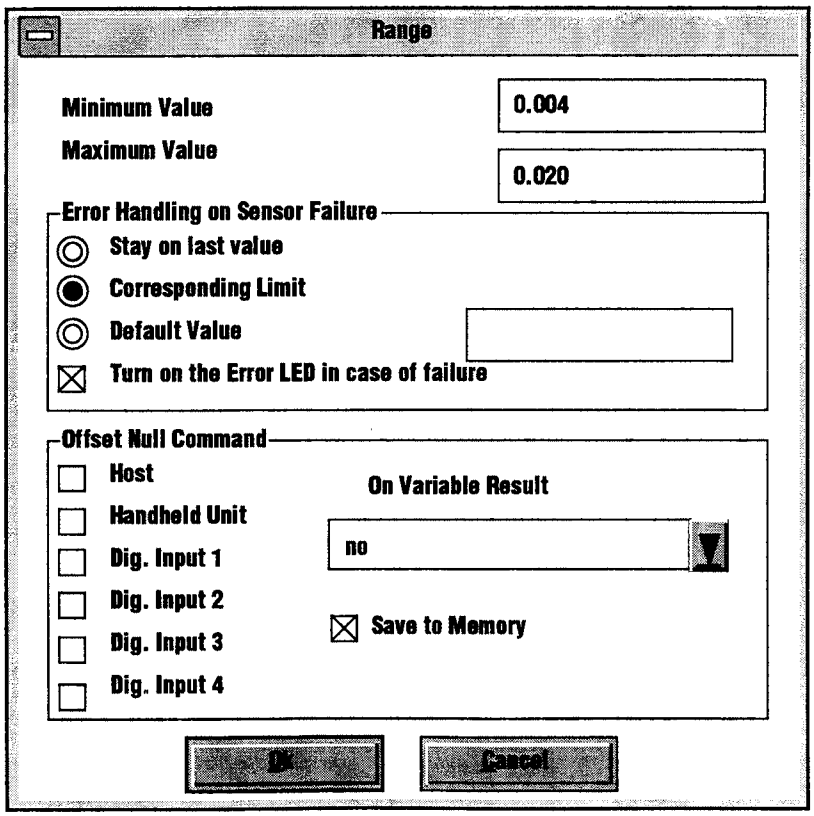
"Minimum Value" and "Maximum Value" boxes allow the user to enter limits on the range of the variable.

NOTE:
Input variable Range Minimum and Maximum values use the engineering unit, scaling, and offset specified in the "Format" field, page 45.

The "Error Handling on Sensor Failure" selection sets what action the variable is to take if the connected input burns out or a lead wire breaks. There is also a box to check to configure the Module's front panel LED to light in the event of sensor failure detection on this variable (Refer to page 90 for a summary of LED function.)

"Offset Null Command" designates the source for an override command. Enabling one of the choices for this parameter configures the input variable to accept as a setting any value received from the designated source — regardless of the value from the connected sensor.

Figure 28. Configuring "Range" of Analog Input Variables



The "On Variable Result" pull-down list in "Offset Null Command" designates a source variable, and a threshold value for the override.

Clicking "Save to Memory" configures the module to save to memory the override value from the designated source.

5a. Click/Select and/or Enter the appropriate settings for the variable.

5b. Click/Select "Ok" to accept the parameters and return to the Main Configuration screen.

6. Figure 29 shows the dialog box for the "Range/Error" field of a Digital Input variable.

NOTE:
The "Range" field is only active if the Digital Input variable's "Type of Measurement" selection is for a cumulative, up/down, or quadrature counter.

"Reset" allows the user to specify another variable that will reset the counter. It can be from:

A Host command

A command from a hand-held configurator (consult factory for availability)

A "high" state (pulse) detected on a designated Digital Input (1, 2, 3, or 4)

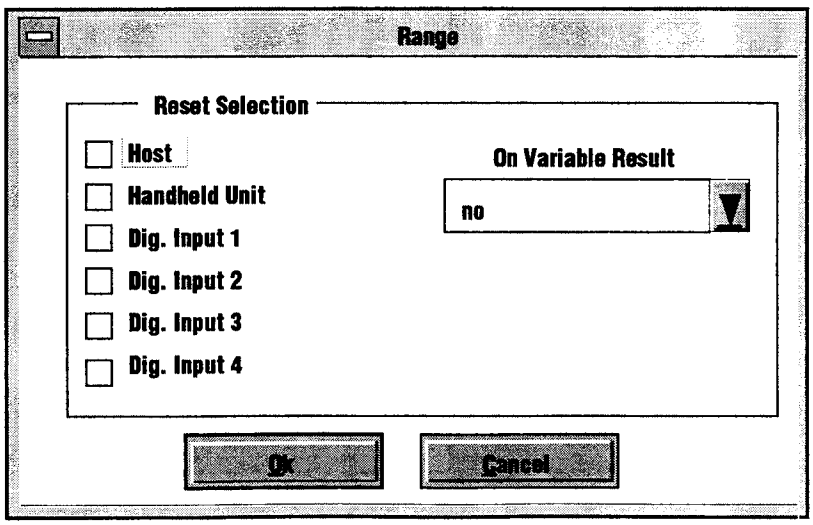
A value greater than 0.5 on a designated variable (use the "On Variable Result" pull-down list). This affords the added flexibility of specifying resets based on variables other than those assigned to the available digital inputs channels; variables types such as arithmetic, analog input, etc., can be used.

6a. Click/Select and/or Enter the appropriate settings for the variable.

6b. Click/Select "Ok" to accept the parameters and return to the Main Configuration screen.

(Explanation of "Range/Error" field continues...)

Figure 29. *Configuring "Range" (Reset) for Digital Counter Input Variables*



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7. Figure 30 shows the "Range/Error" dialog box as it appears when setting the parameter for Digital Output variables whose "Type of Measurement" is set for "Host" or "Process" controlled. Figure 31 shows "Range/Error" for "Pulse-width Modulated" output.

The "Error Handling on Communications Timeout" dialog allows the user to choose between a Host or Process controlled Digital Output variable that ignores communications timeout (due, for instance, to wire break), or defaults to a defined state.

Figure 30

An "Independent from Timeout" selection means that the variable will continue to provide Host or Process controlled output, regardless of the state of the communications. Note, however, that if communications with the Host are lost, Host controlled digital outputs will hold their last state.

Selecting "Default Value" sets the variable to either a "1" or a "0" in the event of a timeout. If this setting is chosen, enter either state in the space provided.

Figure 31

For Pulse-width Modulated Digital Output, the dialog box includes the same error handling dialog that is used with the other types of Digital Outputs (see above), and adds entry boxes for setting the duration of the output pulse at 0 and 100%. Refer to page 59-60 for instructions on setting the time base and source variable (presumably it would be an analog input).

7a. Click/Select and/or Enter the appropriate settings for the variable.

7b. Click/Select "Ok" to accept the parameters and return to the Main Configuration screen.

Figure 30. *Configuring "Range/Error" for Host or Process Controlled Digital Output Variables*

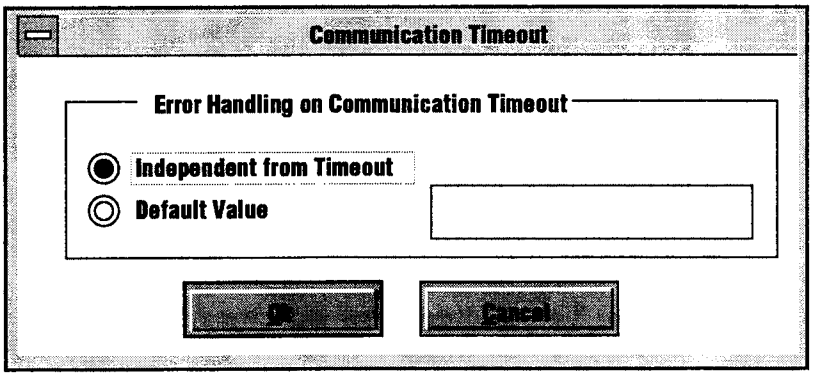
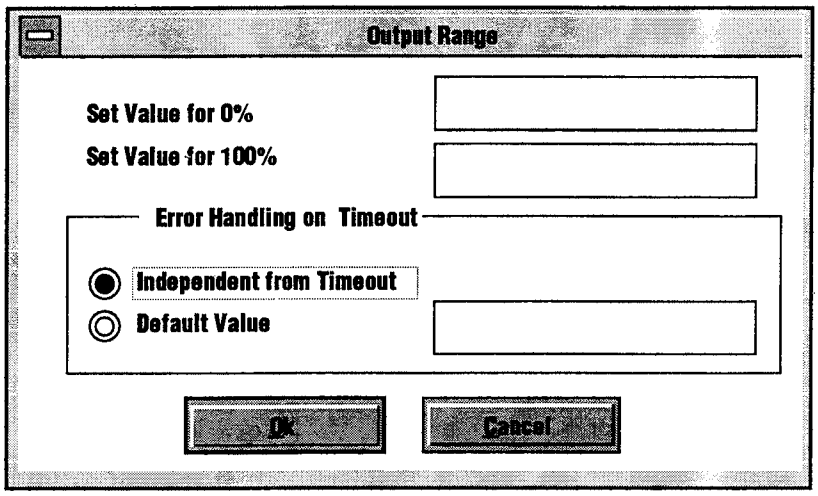


Figure 31. Configuring "Range/Error" for Pulse Width Modulated Digital Output Variables



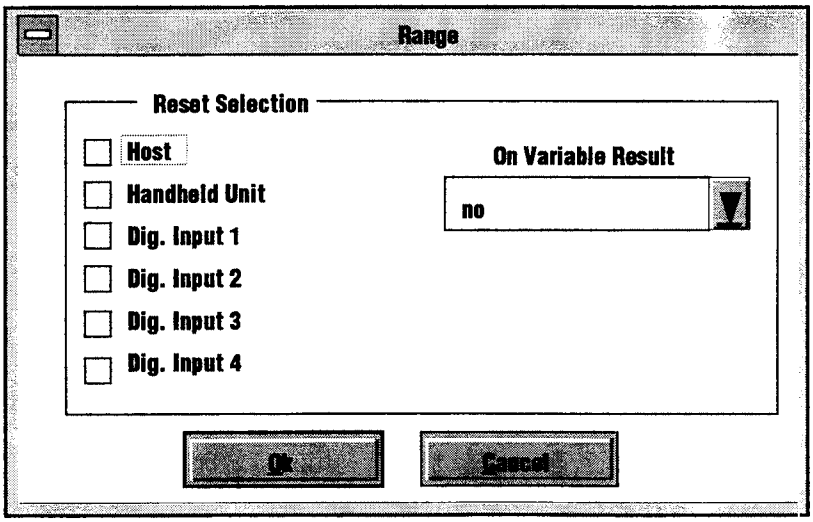
8. Figure 32 shows what the "Range/Error" dialog box looks like for Arithmetic variables. As with the dialog for Digital Input variables, there are settings that designate the source for arithmetic resets (zeroing)".

8a. Click/Select and/or Enter the appropriate settings for the variable.

8b. Click/Select "Ok" to accept the parameters and return to the Main Configuration screen.

(Explanation of "Range/Error" field continues...)

Figure 32. Configuring "Range" (Reset) for Arithmetic Variables



EQUATION STATION

(...continued from preceding page.)

9. Figure 33 shows the "Range/Error" dialog box for Setpoint variables.

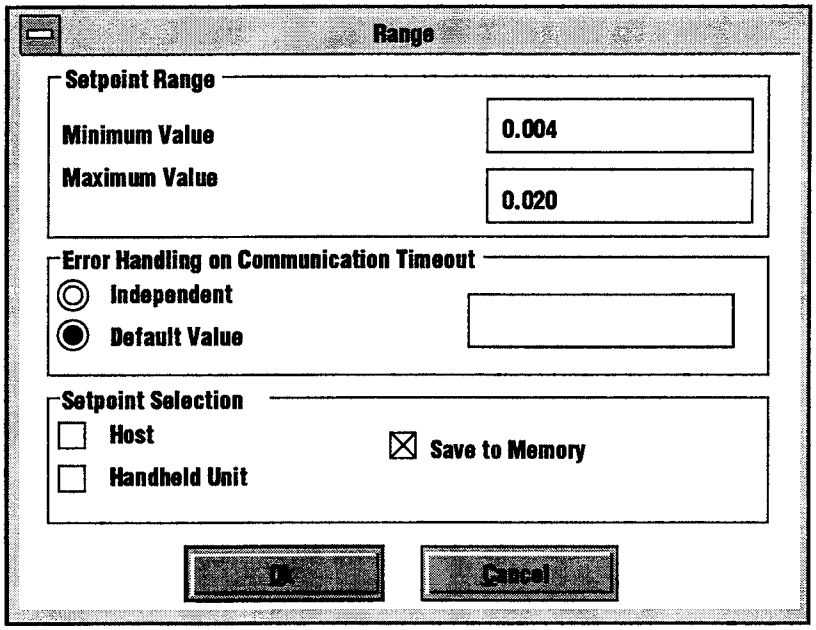
This version of the dialog provides entry spaces to specify a range for the setpoint, determining the variable's functioning in the event of a communications timeout error, and selections for designation of either Host or Handheld source and saving the setpoint to memory (consult the factory for availability of the handheld unit).

Note that the "Default Value" entry must be between the values set for "Maximum" and "Minimum" (inclusive).

9a. Click/Select and/or Enter the appropriate settings for the variable.

9b. Click/Select "Ok" to accept the parameters and return to the Main Configuration screen.

Figure 33. Configuring "Range/Error" for Setpoint Variables



Modifying Variables — "Additionals"

This field is the repository for all of the parameters of a variable not covered by the other fields. The settings available depend upon the type of variable being modified, and in some cases its "Sensor" and "Type of Measurement" settings.

Table 4 summarizes the parameters available in the "Additionals" field.

To set "Additionals" start at the Main Configuration screen.

1. **Click/Select or use the cursor movement keys to highlight the variable whose "Additionals" parameters are to be set.**
2. **Click/Select the "Additionals" field,**

   OR

   Pull down the "Settings" menu, and Click/Select the "Additionals" item.
3. **For Analog Input "Additionals", GO TO Step 4, page 56.**

   For Digital Frequency Input "Additionals", GO TO Step 5, page 56.

   For Digital Counter Input "Additionals", GO TO Step 6, page 57.

   For Process-controlled Output "Additionals", GO TO Step 7, page 58.

   For Pulse-width Modulated Output "Additionals", GO TO Step 8, page 59.

   For Arithmetic "Additionals", GO TO Step 9, page 60.

   For Alarm "Additionals", GO TO Step 10, page 63.

(Explanation of the "Additionals" field continues...)

Table 4. Setting "Additionals" Field Parameters

Variable	Type of Measurement	Additionals
Analog Input	All	Low-pass Filter Timebase or Sample-averaging Filter Settings
Digital Input	Status	Not Used
	Frequency	Scaling Factor and Timebase Setting
	All Counter Types	Scaling Factor
Digital Output	Host Controlled	Not Used
	Process Controlled	Source Variable Designation, Trip Point and Deadband Thresholds
	Pulse Width Modulated	Source Variable Designation and Timebase Setting
Arithmetic	–	Formula
Setpoint	–	Not Used
Alarm	–	Source Variable Designation, Trip Point and Deadband Thresholds

(...continued from preceding page.)

4. **Figure 34 shows the dialog box for the Analog Input variable "Additionals" field.**

   Click/Select the type of filter to be used, if any, and enter the filtering timebase in the box provided.

   The "`Filter Settling Time`" entry may range from 1 to 1000 seconds. Use this setting to "average out" inputs that tend to fluctuate in a linear fashion, over time.

   The "`Sample Size to Average`" entry may range from 1 to 1000 samples. This is the number of samples averaged at the module scan rate (refer to the specifications listing, page 4) to produce a reading. Use this setting to "average out" inputs that tend to spike and/or dive.

   4a. **Click/Select "Ok" to accept the parameters and return to the Main Configuration screen.**

5. **Figure 35 shows the dialog box for a Digital Input variable configured as a Frequency in "`Type of Measurement`".**

Figure 34. Setting the "`Additionals`" for an Analog Input Variable

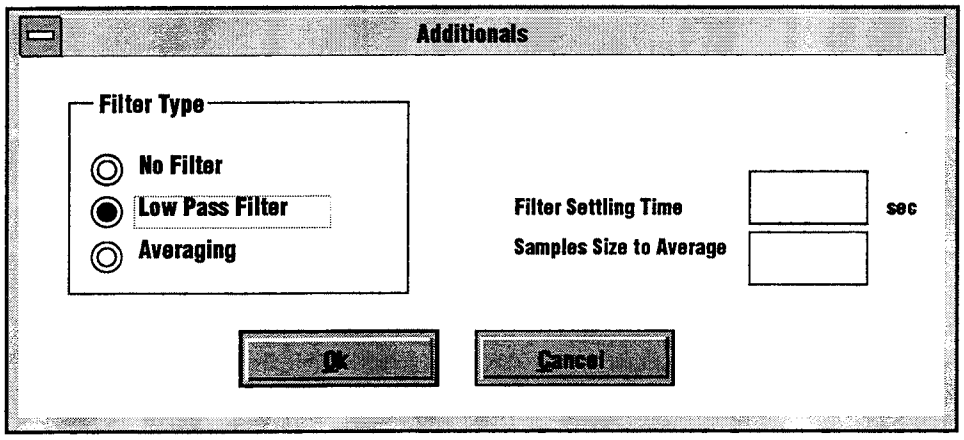
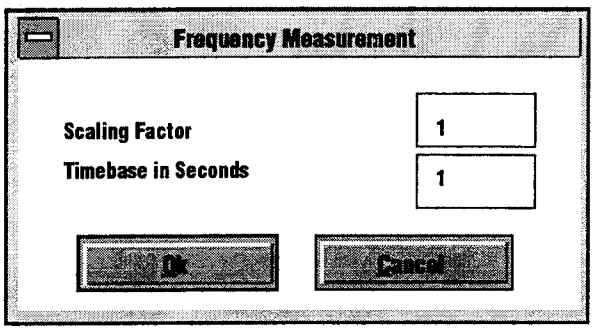


Figure 35. Setting the "Additionals" for a Frequency (Digital) Input



Enter the "Scaling Factor" (between 0 and 9999999) and the "Timebase" (between 0.1 and 10 seconds) to be used.

5a. Click/Select "Ok" to accept the parameters and return to the Main Configuration screen.

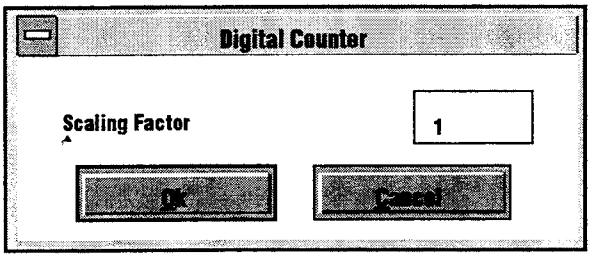
6. Figure 36 shows the dialog box for a Digital Input variable configured as a Counter (cumulative, up/down, quadrature) in "Type of Measurement".

Enter the "Scaling Factor" (between 0 and 9999999) to be used.

6a. Click/Select "Ok" to accept the parameters and return to the Main Configuration screen.

(Explanation of the "Additionals" parameter continues...)

*Figure 36. Configuring "**Additionals**" for Counter Inputs*



(...continued from preceding page.)

7. Figure 37 shows the dialog box for a Digital Output variable configured as Process-controlled in "Type of Measurement".

IMPORTANT HINT:
Alarm, Process-controlled, Pulse-width Modulated, Arithmetic, and Analog Output variables all require the designation of at least one other variable in the Configuration File as a source.

*It is easier to add all source variables **FIRST**, and to add Alarms, Process-controlled Digital Outputs, Pulse-width Modulated Outputs, Arithmetic variables, and Analog Output variables **AFTER** their sources are "above" them in the Configuration File.*

Click/Select the first "Source" pull-down list to designate a variable upon which the digital output is to be based.

7a. Click/Select "Change".

7b. Click/Select the type of threshold appropriate for the application.

Table 5 summarizes the meanings of the symbols used to represent the thresholds shown in the "Threshold Change" dialog box.

7c. Click/Select "Ok" to return to the "Threshold Selection" dialog box.

The selection made in Step 7b will be reflected on the display.

7d. Click/Select the pull-down list boxes for each "Value" (Figure 37) used in the determination of a threshold. Choose a variable, or enter a value.

Figure 37. Configuring the "Additionals" for a Process-controlled Digital Output Variable

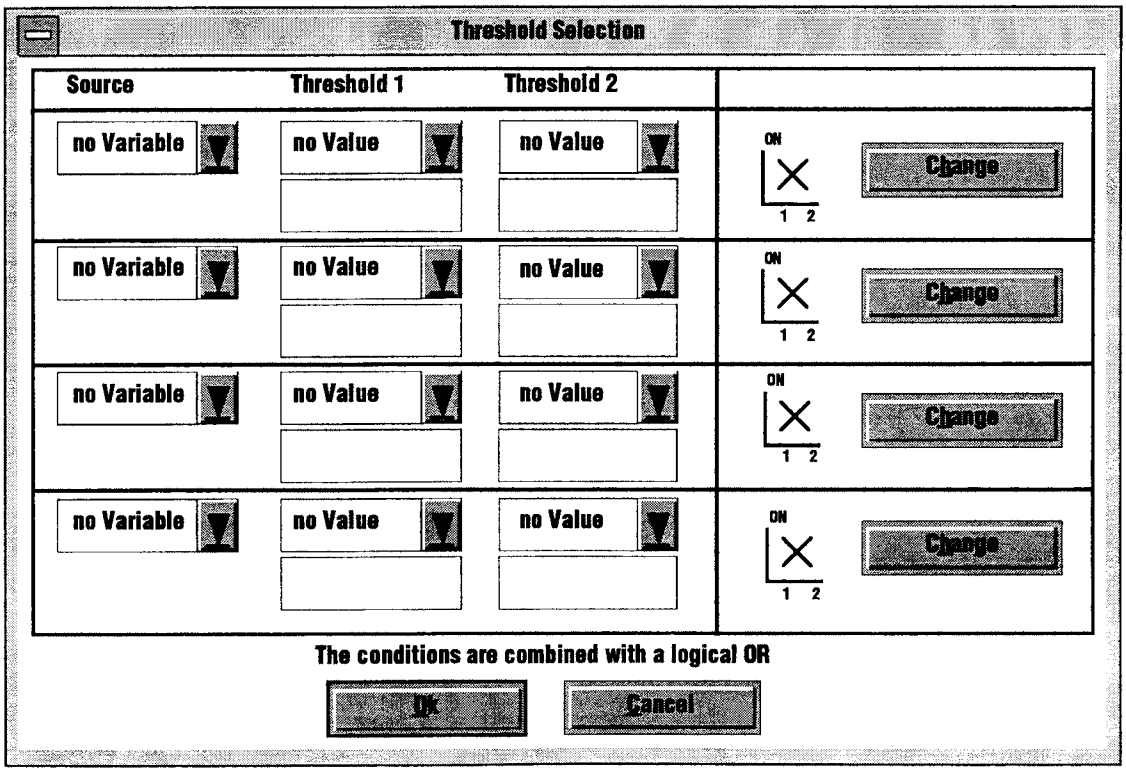
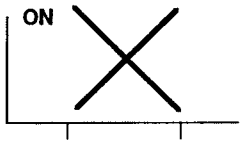
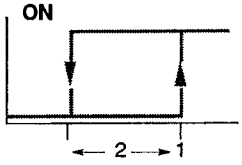


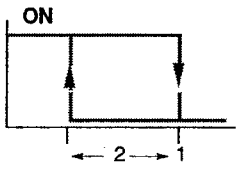
Table 5. Setting Thresholds and Deadbands



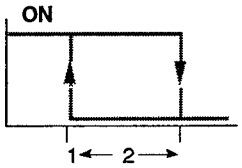
NO ALARM.



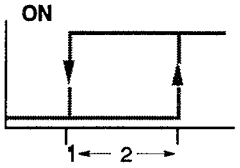
HIGH NON-FAILSAFE w/DEADBAND
OFF (LOGIC "0") UNLESS SOURCE VARIABLE REACHES OR EXCEEDS VALUE 1.
ON (LOGIC "1") UNLESS SOURCE VARIABLE DROPS BELOW POINT DETERMINED BY VALUE 1 – VALUE 2.



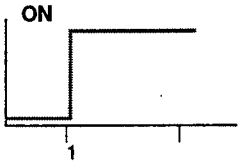
HIGH FAILSAFE w/DEADBAND
ON (LOGIC "1") UNLESS SOURCE VARIABLE REACHES/EXCEEDS VALUE 1 (OR POWER FAILURE OCCURS)
OFF (LOGIC "0") UNLESS SOURCE VARIABLE REACHES/DROPS BELOW POINT DETERMINED BY VALUE 1 – VALUE 2.



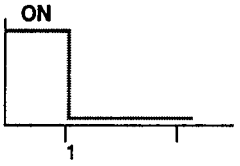
LOW NON-FAILSAFE w/DEADBAND
OFF (LOGIC "0") UNLESS SOURCE VARIABLE DROPS BELOW VALUE 1.
ON (LOGIC "1") UNLESS SOURCE VARIABLE REACHES OR EXCEEDS POINT DETERMINED BY VALUE 1 + VALUE 2.



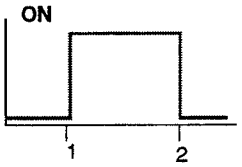
LOW FAILSAFE w/DEADBAND
ON (LOGIC "1") UNLESS SOURCE VARIABLE DROPS BELOW VALUE 1 (OR POWER FAILURE OCCURS)
OFF (LOGIC "0") UNLESS SOURCE VARIABLE REACHES OR EXCEEDS POINT DETERMINED BY VALUE 1 + VALUE 2.



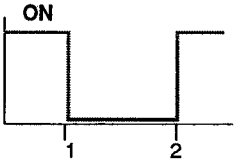
HIGH LOGIC
OFF (LOGIC "0") UNLESS SOURCE VARIABLE REACHES/EXCEEDS VALUE 1.



LOW LOGIC
ON (LOGIC "1") UNLESS SOURCE VARIABLE REACHES/EXCEEDS VALUE 1.



RANGE DETECT HIGH
GOES HIGH (LOGIC "1") WHEN SOURCE VARIABLE IS BETWEEN VALUE 1 AND VALUE 2.



RANGE DETECT LOW
GOES LOW (LOGIC "0") WHEN SOURCE VARIABLE IS BETWEEN VALUE 1 AND VALUE 2.

NOTE:

Process-controlled Digital Outputs can be based on up to 4 sets of thresholds "chained together" with a logical "OR". Digital Output "x", for example, can be configured to change state if source variable "y" exceeds its threshold, OR if source variable "z" exceeds its threshold.

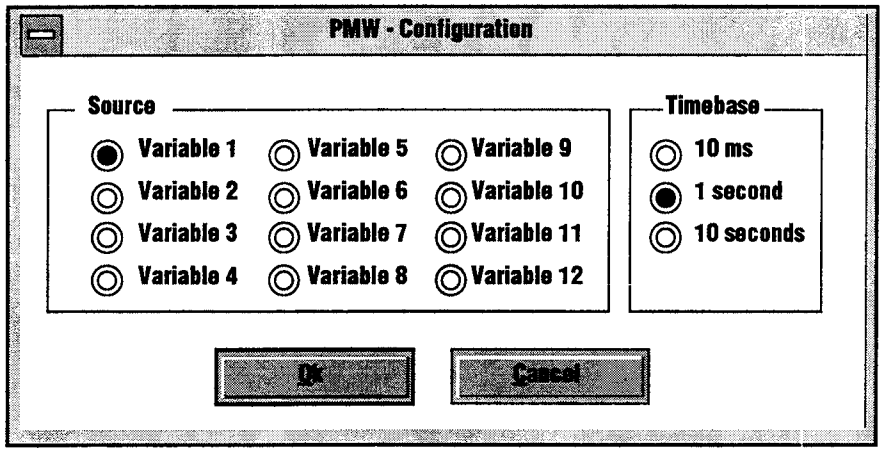
To chain source variables, pull down the second "`Source`" list (Figure 37), repeating Steps 7 through 7d.

7e. From the "`Threshold Selection`" dialog box, Click/Select "Ok" to accept the parameter settings and return to the Main Configuration Screen.

8. Figure 38 shows the dialog box for a Digital Output variable configured as Pulse-width Modulated in its "Type of Measurement" field.

(Explanation of the "`Additionals`" parameter continue...)

Figure 38. Setting the "Additionals" for Pulse-width Modulated Digital Outputs



(..continued from preceding page.)

IMPORTANT HINT:
Alarm, Process-controlled, Pulse-width Modulated, Arithmetic, and Analog Output variables all require the designation of at least one other variable in the Configuration File as a source.

*It is easier to add all source variables **FIRST**, and to add Alarms, Process-controlled Digital Outputs, Pulse-width Modulated Outputs, Arithmetic variables, and Analog Output variables **AFTER** their sources are "above" them in the Configuration File.*

Click/Select the variable to serve as the source for the pulse-width modulated digital output from those active in the "Source" section of the dialog box.

8a. Click/Select the "Timebase" from those listed on the right.

8b. Click/Select "Ok" to accept the parameters and return to the Main Configuration screen.

9. Figure 39 shows the "Formula" dialog box for an Arithmetic variable. Figure 40 shows what the box looks like if the Configuration File was opened for a module equipped with either the -MD or -MAO options.

Click/Select the listed variables and functions to devise a formula.

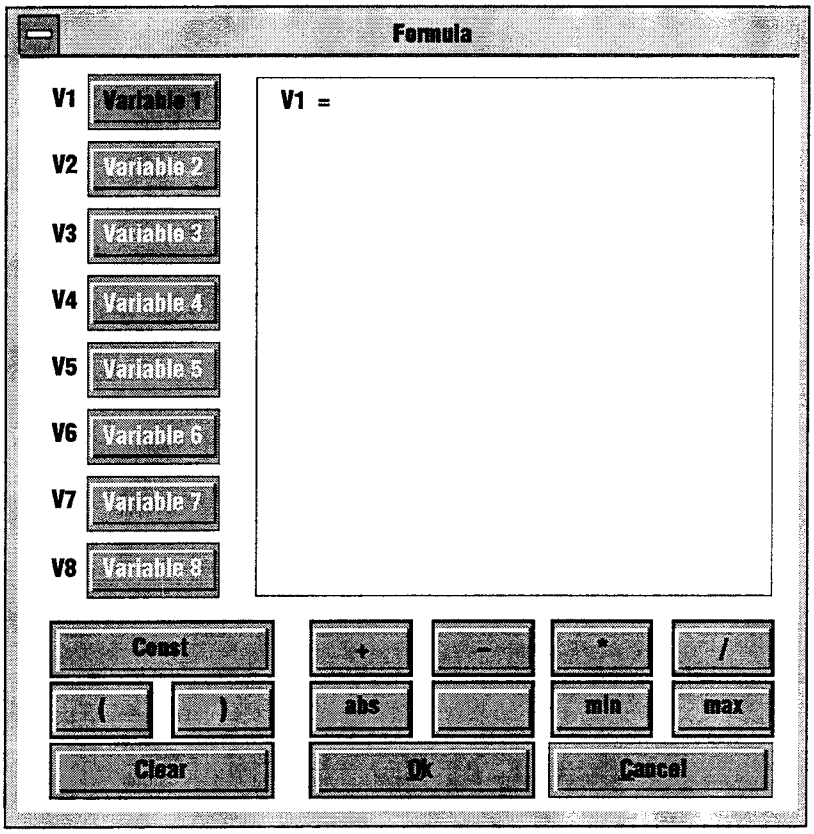
Use "Clear" to erase the formula and start again.

Use "Const." to add a numerical constant. Choose from values for *pi* (π, 3.141592654), acceleration due to gravity (g, 9.80665 m/sec/sec), and the base of natural logarithms (e, 2.718281828459).

Some notes on other functions in the dialog box:

- "sqrt" outputs the square root of the named variable or constant
- "exp" outputs the exponential of the named variable or constant (the inverse of "ln").
- "abs" outputs the absolute value of the named variable or constant

Figure 39. The Formula Input Dialog Box, Standard MDS Modules

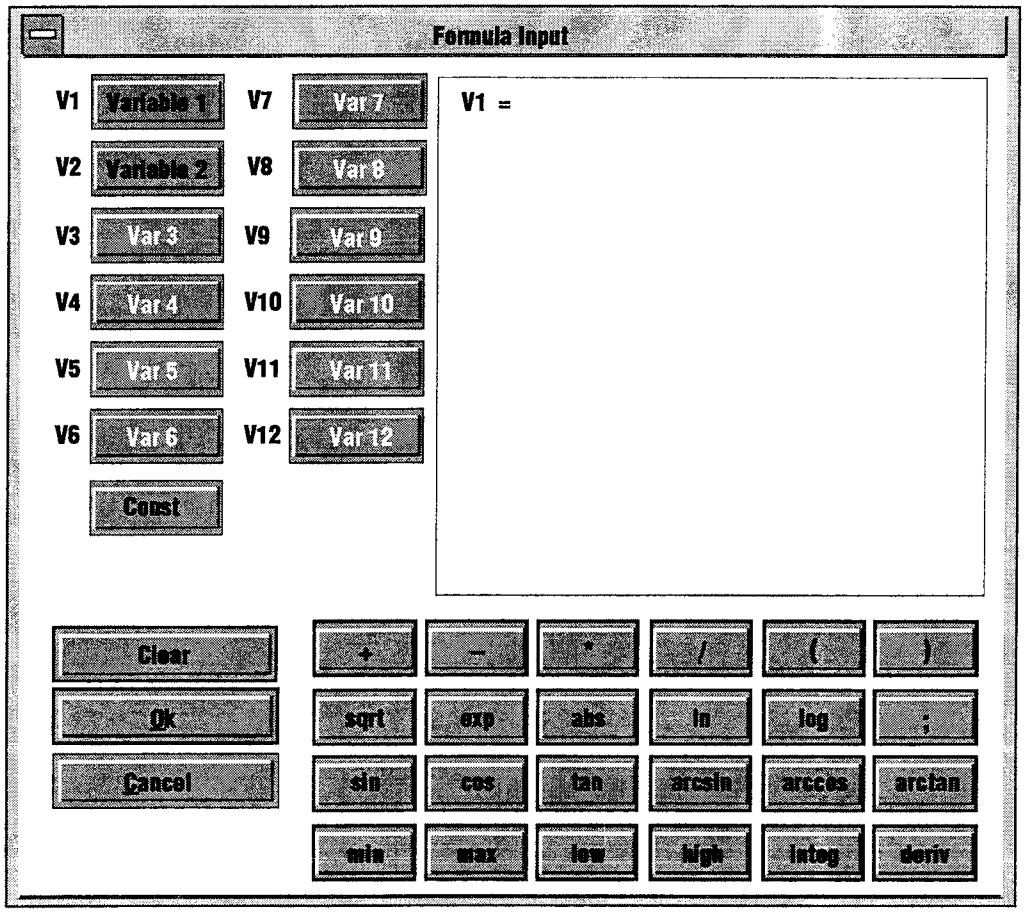


- "`In`" outputs the natural log of the named variable or constant (the inverse of "`exp`").
- "`log`" outputs the $base_{10}$ log of the named variable or constant
- "`;`" is used as a delimiter when designating a series of variables with the "`low`" or "`high`" functions
- "`sin`" outputs the sine of the named variable or constant
- "`cos`" outputs the cosine of the named value or constant
- "`tan`" outputs the tangent of the named value or constant
- "`arcsin`" outputs the arc sine ($\sin^{-1}x$) of the named value or constant
- "`arccos`" outputs the arc cosine ($\cos^{-1}x$) of the named value or constant
- "`arctan`" outputs the arc tangent ($\tan^{-1}x$) of the named value or constant
- "`min`" outputs the lowest level of the named variable since its last reset
- "`max`" outputs the highest level of the named variable since its last reset
- "`low`" compares all the values in a named series of variables and/or constants and outputs the lowest (uses "`;`" as a delimiter)

(Explanation of the "`Additionals`" parameter continue...)

EQUATION STATION

*Figure 40. Setting the "**Additionals**" for Arithmetic Variables, MD- or MAO-equipped MDS Modules*



(..continued from preceding page.)

- "`high`" compares all the values in a named series of variables and/or constants and outputs the highest (uses "`;`" as a delimiter)
- "`integ`" integrates the named variable or constant over a timebase of 1 second
- "`deriv`" outputs the derivative of the named Analog Input variable over a time-base of 1 second.

9a. Click/Select "Ok" when complete to return to the Main Configuration screen.

Error messages are displayed on the screen when "Ok" is Clicked/ Selected when the equation is incomplete or incorrect.

IMPORTANT HINT:

Alarm, Process-controlled, Pulse-width Modulated, Arithmetic, and Analog Output variables all require the designation of at least one other variable in the Configuration File as a source.

*It is easier to add all source variables **FIRST**, and to add Alarms, Process-controlled Digital Outputs, Pulse-width Modulated Outputs, Arithmetic variables, and Analog Output variables **AFTER** their sources are "above" them in the Configuration File.*

10. Figure 41 shows the dialog box for an Alarm variable in "Type of Measurement".

IMPORTANT HINT:
Alarm, Process-controlled, Pulse-width Modulated, Arithmetic, and Analog Output variables all require the designation of at least one other variable in the Configuration File as a source.

*It is easier to add all source variables **FIRST**, and to add Alarms, Process-controlled Digital Outputs, Pulse-width Modulated Outputs, Arithmetic variables, and Analog Output variables **AFTER** their sources are "above" them in the Configuration File.*

Click/Select the first "Source" pull-down list to designate a variable upon which the digital output is to be based.

10a. Click/Select "Change".

10b. Click/Select the type of threshold appropriate for the application.

Table 5 (repeated on the next page) summarizes the meanings of the symbols used to represent the thresholds shown in the "Threshold Change" dialog box.

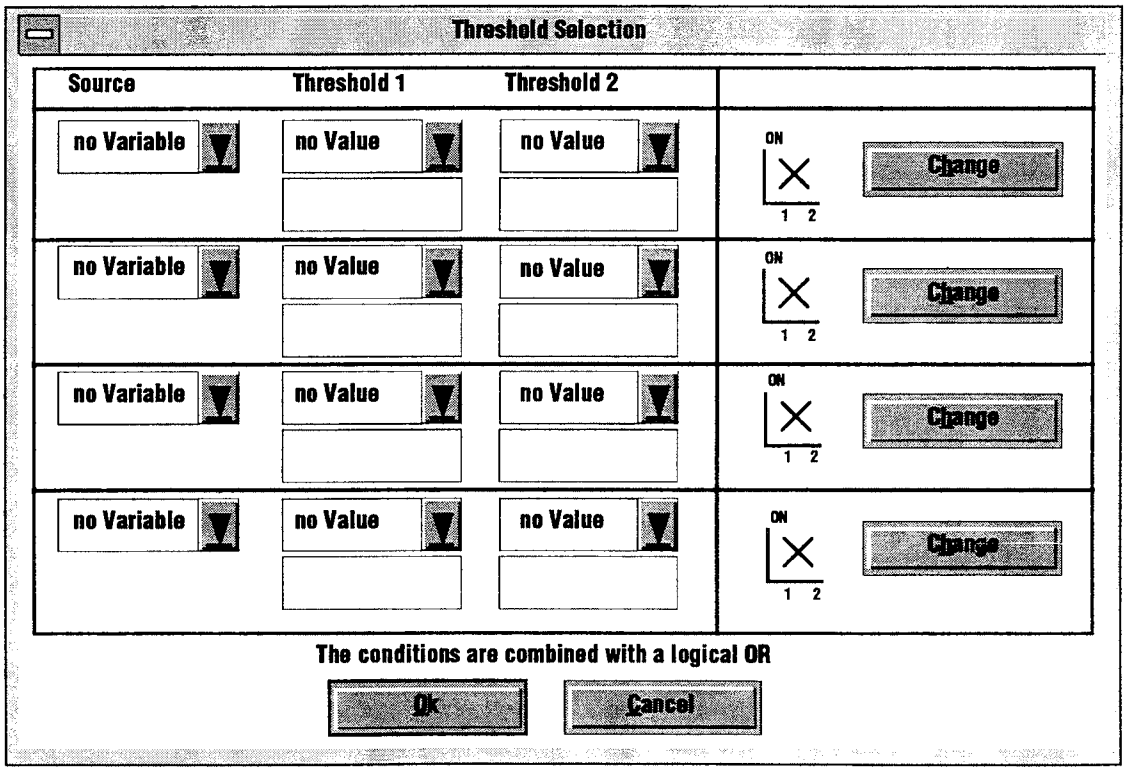
10c. Click/Select "Ok" to return to the "Threshold Selection" dialog box.

The selection made in Step 10b will be reflected on the display.

10d. Click/Select the pull-down list boxes for each "Value" (Figure 34) used in the determination of a threshold. Choose a variable, or enter a value.

(Explanation of the "Additionals" parameter continue...)

Figure 41. *Configuring the "Additionals" for a Process-controlled Digital Output Variable*



EQUATION STATION

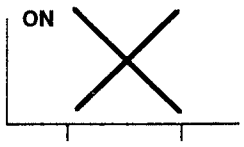
(..continued from preceding page.)

NOTE:
Process-controlled Digital Outputs can be based on up to 4 sets of thresholds "chained together" with a logical "OR". Digital Output "x", for example, can be configured to change state if source variable "y" exceeds its threshold, OR if source variable "z" exceeds its threshold.

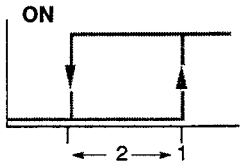
To chain source variables, pull down the second "`Source`" list (Figure 41), repeating Steps 10 through 10d.

10e. From the "`Threshold Selection`" dialog box, Click/Select "Ok" to accept the parameter settings and return to the Main Configuration Screen.

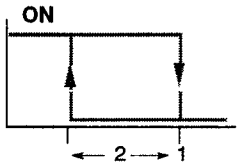
Table 5. *Setting Thresholds and Deadbands*



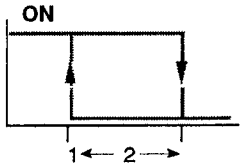
NO ALARM.



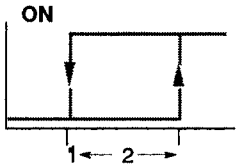
HIGH NON-FAILSAFE w/DEADBAND
OFF (LOGIC "0") UNLESS SOURCE VARIABLE REACHES OR EXCEEDS VALUE 1.
ON (LOGIC "1") UNLESS SOURCE VARIABLE DROPS BELOW POINT DETERMINED BY VALUE 1 – VALUE 2.



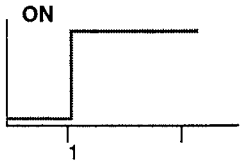
HIGH FAILSAFE w/DEADBAND
ON (LOGIC "1") UNLESS SOURCE VARIABLE REACHES/EXCEEDS VALUE 1 (OR POWER FAILURE OCCURS)
OFF (LOGIC "0") UNLESS SOURCE VARIABLE REACHES/DROPS BELOW POINT DETERMINED BY VALUE 1 – VALUE 2.



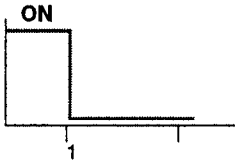
LOW NON-FAILSAFE w/DEADBAND
OFF (LOGIC "0") UNLESS SOURCE VARIABLE DROPS BELOW VALUE 1.
ON (LOGIC "1") UNLESS SOURCE VARIABLE REACHES OR EXCEEDS POINT DETERMINED BY VALUE 1 + VALUE 2.



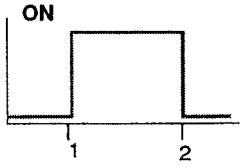
LOW FAILSAFE w/DEADBAND
ON (LOGIC "1") UNLESS SOURCE VARIABLE DROPS BELOW VALUE 1 (OR POWER FAILURE OCCURS)
OFF (LOGIC "0") UNLESS SOURCE VARIABLE REACHES OR EXCEEDS POINT DETERMINED BY VALUE 1 + VALUE 2.



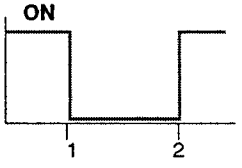
HIGH LOGIC
OFF (LOGIC "0") UNLESS SOURCE VARIABLE REACHES/EXCEEDS VALUE 1.



LOW LOGIC
ON (LOGIC "1") UNLESS SOURCE VARIABLE REACHES/EXCEEDS VALUE 1.



RANGE DETECT HIGH
GOES HIGH (LOGIC "1") WHEN SOURCE VARIABLE IS BETWEEN VALUE 1 AND VALUE 2.



RANGE DETECT LOW
GOES LOW (LOGIC "0") WHEN SOURCE VARIABLE IS BETWEEN VALUE 1 AND VALUE 2.

Configuring MDS Modules — TEST the Configuration File/Module

Before an MDS module is installed in an application, it should be tested to make sure that all of the variables are functioning as configured.

NOTE:
A module must be connected in order to test the Configuration File. If "building" a Configuration File without a module connected, skip this procedure.

Refer to pages 16 or 17 for hookup diagrams to use when connecting a module for configuration.

To test the Configuration File for a module:

1. **Click/Select the "Utilities" pull-down menu on the Main Configuration screen.**
2. **Click/Select the "Measure" menu item.**

   A "Warning" message appears indicating that the active Configuration File is about to be downloaded to the connected module.

NOTE:
To test the active Configuration File, it must be downloaded to the connected module.

3. **Click/Select "Yes".**

   A message confirming a successful download, Figure 42, appears next.

4. **Click/Select "Ok".**

   The screen clears, and something similar to the screen shown in Figure 43 appears. The user's screen will differ according to the variables and their configuration.

5. **Make sure that all of the variables shown in the "Measure" utility display box are functioning as expected.**
6. **Refer to the hookup diagrams on pages 80 through 89 to find out how to connect test inputs and/or outputs that function with the variables in the active Configuration File.**
7. **Click/Select "Cancel" when satisfied that the connected module is executing the active Configuration File as desired.**

Figure 42. *Confirming a Configuration File Download*

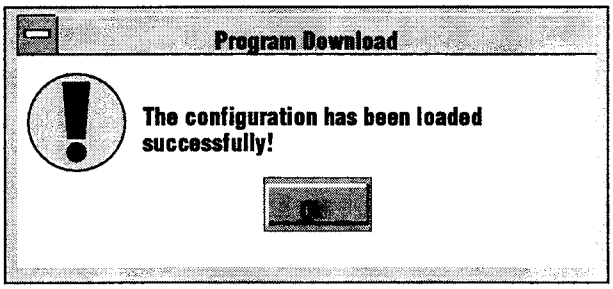
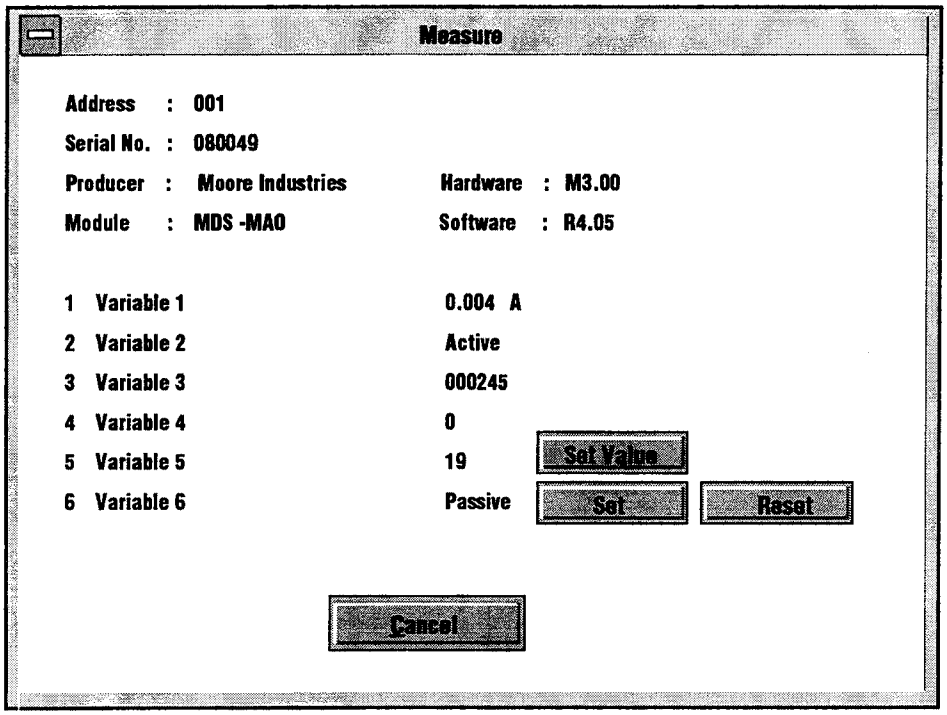


Figure 43. Testing the Active Configuration File using the "Measure" Utility — Example



Configuring MDS Modules — SET/CHANGE Communications Parameters

This section describes how to set:

- Protocol
- Communications Address
- Baud Rate
- Parity
- Stop Bits
- Measurement Rate
- Communication Time-out
- Answer Delay

The basic rules for setting ***I/O EQUATION STATION*** communications parameters are:

- One Protocol - The Host and all of the modules inter-connected by one Comm Link must use the same communications protocol
- No duplicate Addresses - The communications address of each module connected to one Comm Link must be unique on that link.
- One Baud Rate - The Host and all of the modules inter-connected by one Comm Link must use the same baud rate
- One Parity and one Start/Stop Bits setting - The Host and all of the modules inter-connected on one Comm Link must use the same setting for parity, start bits, and stop bits
- Multiple Measurement Rates, Communications Timeouts, and Answer Delays - Each module can have its own setting for these parameters

Changing Communications Protocols

Unless otherwise specified by the customer, MDS modules are shipped from the factory configured to communicate with the following parameters:

- MODBUS RTU
- 9600 Baud
- No Parity
- 1 Stop Bit

IMPORTANT:
Changing Communications Protocol resets the Configuration File in the connected module to its factory defaults.

If a change is necessary at this point in the configuration procedure, make sure to ***SAVE the active Configuration File*** *before changing protocols (refer to page 73).*

After successfully changing protocols, refer to page 75 for instructions on opening the saved file.

Refer to page 66 for instructions on how to change the Communications Protocol of the connected module.

Setting Address, Baud Rate, Parity, and/or Stop Bits

Every MDS module that uses the same Comm Link in an ***I/O EQUATION STATION*** application must be given a communications address that is *unique* on that Link. All modules connected on a given Comm Link must be configured with *the same* baud rate, parity, and stop bit settings, and all these settings must match those of the Host in order to carry out communications.

To set the module communications parameters:

1. **Click/Select the "Communications" pull-down menu from the Main Configuration screen.**

2. **Choose the "Module Parameters" menu item.**

   The "Module Parameters" dialog box appears, as shown in Figure 44.

3. **Refer to the documentation for the Host that is to be used in the intended *I/O EQUATION STATION* application,**

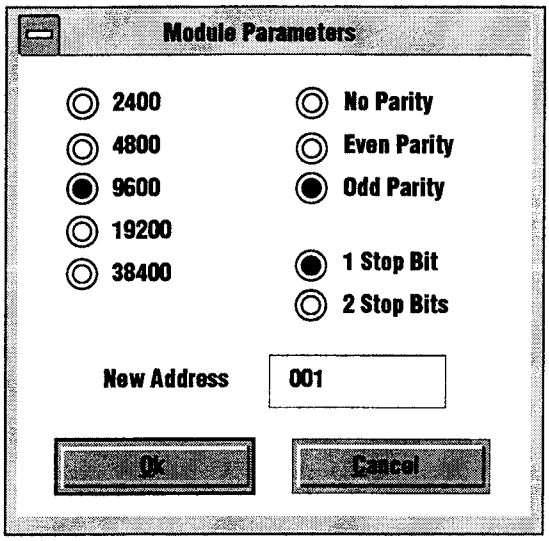
   AND...

   Click/Select/Enter the desired parameters in the dialog box, according to the requirements.

(Explanation of the Communications Parameters continues...)

EQUATION STATION

Figure 44. Changing the Module Communications Parameters



(...continued from preceding page.)

Address - Each MDS module that is to use the same Data Comm Link in an application must be assigned an address between 001 and 127 that is unique on that Link.

Baud Rate – All of the MDS modules on one Data Comm Link must be configured with the same baud rate, and that rate must match the setting of the Host. Check the specifications of the Host equipment being used before changing the baud rate setting for the connected module. It is possible to set the module rate such that the Host cannot communicate with it (too high or too low).

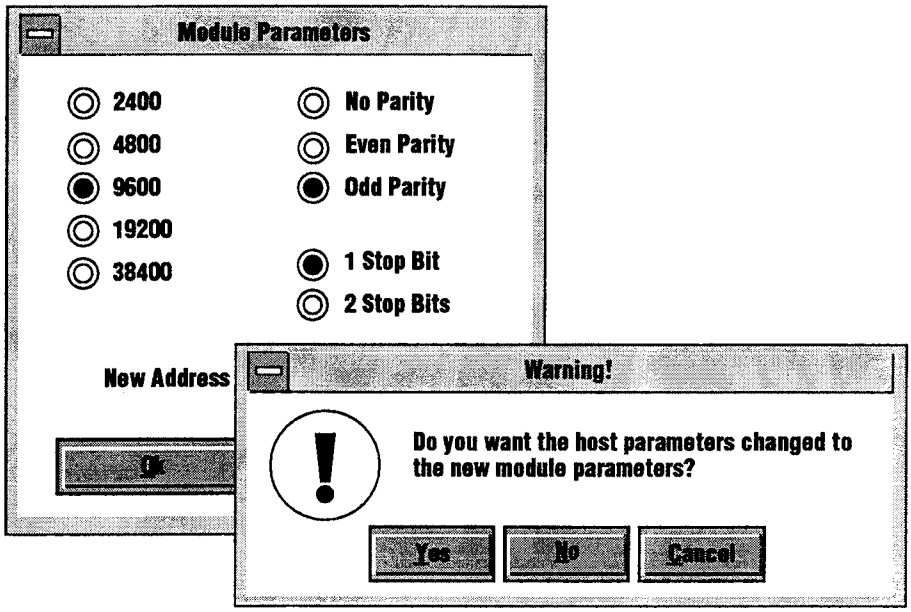
Parity and Stop Bits – All of the MDS modules on one Data Comm Link must be configured with the same Parity and Stop Bits settings, and these settings must match those of the Host.

4. **When Baud rate, Parity, or Stop Bits settings are changed, the Configuration Program prompts the user to change the parameters of the Host to match the new module settings. The "Warning" box shown in Figure 45 illustrates this.**

   Clicking/Selecting "Yes" changes the parameters of the Host and clears the box to the Main Configuration Screen. The "Address" field of the active Configuration File reflects the new module address setting.

HINT:
Make a note of the module address and serial number for future reference in diagramming the installation.

Figure 45. Warning of a Change to Host Communications Parameters



NOTES:

Changing the setting for Baud Rate, Stop Bits, or Parity changes the settings for the Host being used. See Figure 45.

If using the same Host to configure several modules, remember to reset the Host communications parameters accordingly.

The Configuration Program automatically downloads any address changes ***immediately*** *upon exiting the "`Module Parameters`" dialog box. The rest of the Configuration file must be downloaded separately.*

IMPORTANT:

The "No" selection in the dialog box shown in Figure 45 cancels any changes to the Host communications parameters. It ***DOES NOT CANCEL*** *changes to the module communications parameters.*

Communications between Host and the connected module will be severed at this point.

If "No" is Clicked/Selected the communications of the Host ***MUST*** *be changed to match those of the connected module in order to continue with the configuration process.*

Setting Measurement Rate

This is the rate at which an MDS module scans its input channels. The total measurement cycle time for a module is calculated by multiplying the Measurement Rate setting by the number of input channels.

NOTE:
Some types of input use more than one channel, and thus, incur more than one measurement cycle time period.

Refer to "Multiple Inputs" following this section for more information.

In order to provide line noise rejection, the Measurement Rate setting is synched with the frequency of the power being supplied to the module.

To set the Measurement Rate:

1. **Go to the Main Configuration screen.**
2. **Click/Select the "Settings" pull-down menu.**
3. **Click/Select "Measurement Rate".**

   The "Measurement Rate" dialog box appears.
4. **Enter the desired rate in the space provided.**

   The range for the setting is from 50 to 200 Hz, which is one cycle completion every 20 milliseconds (ms) to 5 ms, respectively. 60Hz is the recommended setting for maximum noise rejection.
5. **Click/Select "Ok" to enter the value into the Configuration File and return to the Main Configuration screen.**

Multiple Inputs

As input channels are added to the Configuration File of an MDS module, the amount of time it takes for the module to complete a measurement cycle increases due to the additional analog-to-digital conversions.

When the Measurement Rate setting is entered, the number of inputs present in the active Configuration File are automatically figured in.

NOTE:
Each 3- or 4-wire resistance (RTD) input requires two cycles to develop a reading.

Table 6 summarizes the settings. Refer to Table 2 on page 8 to calculate module throughput.

Table 6. *Summarizing the Measurement Rate Settings*

Number of Input Channels	Cycle Time @ 50Hz	Cycle Time @ 60Hz	Cycle Time @ 200Hz
1	20ms	16.7ms	5ms
2	200ms	166.7ms	50ms
3	300ms	250ms	75ms
4	400ms	333.3ms	100ms

Setting Communications Time Out

The Communication Time Out sets an interval that functions as a "window" during which the module "expects" to be polled or receive instructions from the system Host. If the set period elapses without any activity, effected module outputs default to a "safe" state defined in one of the settings of the "**Range/Error**" field (page 48).

This parameter effects MDS module Digital Output variables, Setpoint variables, and the Analog Output variable available on modules equipped with the -MAO option. The red LED on the front panel of the module indicates the time out status. Refer to page 90 for an explanation of the LED error indications.

1. **Go to the Main Configuration screen.**
2. **Click/Select the "Settings" pull-down menu.**
3. **Click/Select "Communication Timeout".**

   The "Communication Timeout" dialog box appears.
4. **Enter the desired time frame in the space provided.**

   The range for this setting is between 0.0 and 600.0 seconds. The default is 60.0 seconds. A setting of 0 defeats the communications activity monitor.
5. **Click/Select "Ok" to enter the value into the Configuration File and return to the Main Configuration screen.**

Setting Answer Delay

This parameter allows the user to program in a delay period between the module's receipt of a communication/command message from the System Host, and its (the module's) response. Some commercially available SCADA and MMI packages, as well as some modems, require a delay under certain conditions.

To set the delay:

1. **Go to the Main Configuration screen.**
2. **Click/Select the "Settings" pull-down menu.**
3. **Click/Select "Answer Delay".**

   The "Answer Delay" dialog box appears.
4. **Enter the appropriate number of characters to delay in the space provided.**

   Answer Delay is expressed in "characters" between 1 and 85. Each unit represents the amount of time it takes to communicate a single character/bit of data at the particular baud rate between the module and the Host.

   The MDS module default setting is 1 character of delay at any of the available baud rate settings. Check the documentation of the equipment being used in the application for specifications or requirements for any answer delays.
5. **Click/Select "Ok" to enter the value into the active Configuration File and return to the Main Configuration screen.**

Configuring MDS Modules — DOWNLOAD the Configuration File

Once all variables and communications parameters for the connected module have been set, the Configuration File can be downloaded into the MDS module's non-volatile memory.

Before downloading, check that the module:

- Has been assigned its own, system-unique communications address (page 67-69)
- Has been configured with the correct communications protocol (MODBUS or PROFIBUS), and that the settings for baud rate, parity, and stop bits are compatible with any other MDS modules to be installed in the intended application

IMPORTANT:
*If the protocol is changed, the configuration file stored in module memory at the time will be wiped out. Make sure to save the Configuration File to disk (page 73) and to change the communications protocol **BEFORE** downloading.*

- Variables have been configured to work together, where appropriate. None of the variables in the active Configuration File should be showing in "color" on the Main Screen. Refer to page 38 to resolve any conflicts.

To download a Configuration File:

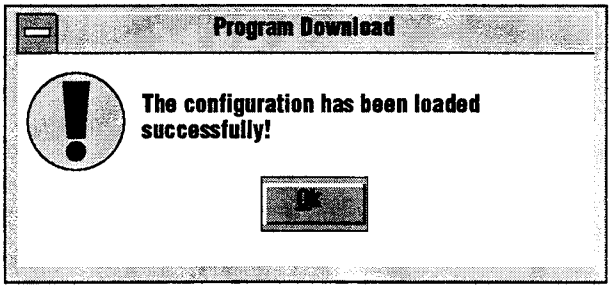
1. **Go to the Main Configuration screen.**
2. **Click/Select the "File" pull-down menu.**
3. **Click/Select "To Module".**

   The active Configuration File — the set of variables showing on the Main Configuration screen — will begin downloading to the connected module.

   The "RUN" LED on the front panel of the module blinks slowly as the file is downloaded into memory. When complete, the screen clears to the dialog box shown in Figure 46.
4. **Click/Select "Ok" to confirm the download, and return to the Main Configuration screen.**

   The connected MDS module is now ready to be installed in the application.

Figure 46. *Confirming a Successful Configuration File Download*



Configuring MDS Modules — SAVE the Configuration File

This procedure is for saving the Configuration File to disk so that it can be retrieved later for things like downloading to other modules, or for modification to a module's parameters, etc.

To save the Configuration File:

1. **Go to the Main Configuration screen.**
2. **Click/Select the "File" pull-down menu.**
3. **Choose "Save As".**

   The "Save As" dialog box will appear. This is a standard Windows-type dialog box with spaces for designating drive, file name, extension, and comments.

   NOTE:
   The default filename extension for Moore Industries MDS module Configuration Files is "isk". Make sure to use this extension in naming files in order to have the filename listed by default in any subsequent loading of Configuration Files from the Host ***I/O EQUATION STATION*** *directory.*

4. **Fill in the various fields of the dialog box according to requirement/ preference.**
5. **Click/Select "Ok" to complete the operation.**

Configuring MDS Modules — Downloading a Configuration File to Multiple Modules

Once a module is configured and checked as described in the earlier procedures of this section, it may be disconnected and installed.

To configure the next module, refer to Figures 6 (page 16) or 7 (page 17), as appropriate, to incorporate the new module into the configuration setup.

When the new module is set up properly and has had time to warm up, the user can then either compose a new Configuration File using the procedures in previous sections of this manual, or the same Configuration File can be downloaded to the new module.

The only parameter that needs to be changed is the communications address. Refer to page 67 for instructions.

Remember that each module that is to be used in an application must be configured with the same communications protocol, the same baud rate, parity, and stop bits settings — but a *different*, unique-to-the-link communications address.

To download the active Configuration File to a newly-connected module:

1. **Go to the Main Configuration**

   Assign a unique communications address to the connected module. Refer to page 67 for instructions.

2. **Click/Select the "File" pull-down menu.**

3. **Click/Select "To New Module".**

   The Configuration Program displays the `Module Selection` dialog box, prompting for the address of the module to which the Configuration File on the screen is to be downloaded.

   The addresses of only those modules responding to Host commands on the Data Comm Link will be shown. If the intended module's address is not shown, refer to page 22 for the steps to take in re-establishing communications with a module.

4. **Click/Select the displayed module that is to receive the Configuration File.**

5. **Click/Select "Ok".**

   The Configuration Program downloads the file on the screen to the addressed module, displaying a confirmation box (Figure 46) when complete.

This procedure can be run for each module in a system.

Re-Configuring MDS Modules — Opening an Existing Configuration File

Once a Configuration File has been saved to the hard (or floppy) disk, it can be retrieved at any time for downloading to, for example, modules added to a system at a later date.

The procedure is the standard, Windows fare:

1. **Go to the Main Configuration screen.**
2. **Click/Select the "File" pull-down menu.**
3. **Click/Select "Open".**

   Figure 47 shows the screen.

   "File Name:" is the field in which the user can enter the name of the file to be opened. "*.isk" is the default.

   - "mds-mao.isk" is the factory-generated file that demonstrates the capabilities of the MDS module when equipped with the -MAO option (described on page 2).
   - "mds-md.isk" is the factory-generated file that demonstrates the MDS equipped with the -MD option (described on page 2).

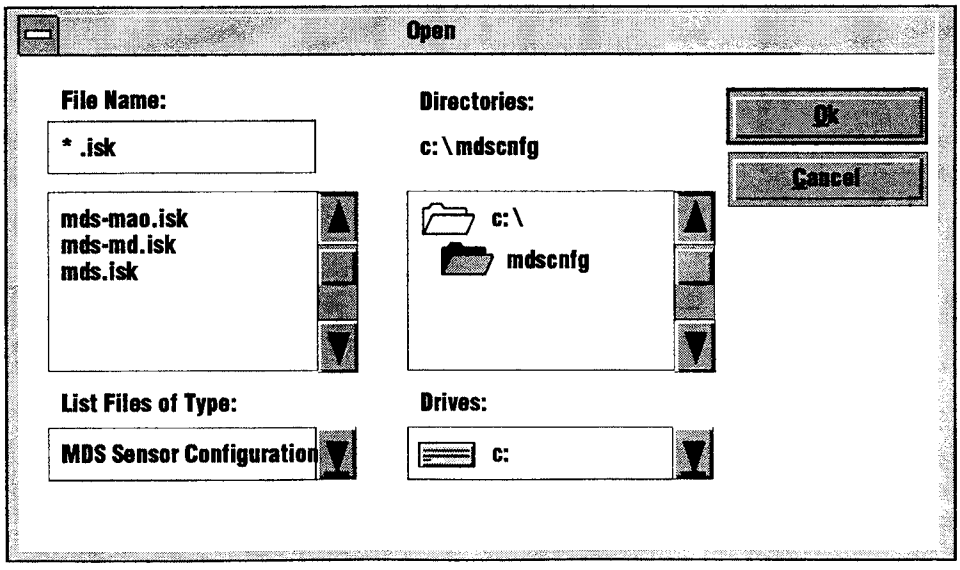
   The "List Files of Type:" field allows the user to constrain the listing of available files according to type.

   - "MDS Sensor Configuration" files are sample files shipped with the module for demonstration purposes.
   - "MDS Configuration" files are created and saved by the user.

   The "Directories:" and "Drives:" fields work in the same manner as in Windows' Program Manager.

4. **Fill in the spaces in the dialog box as appropriate for the desired Configuration File.**
5. **Click/Select "Ok" to call up the file and return to the Main Configuration screen.**

Figure 47. Opening a Configuration File already on Disk



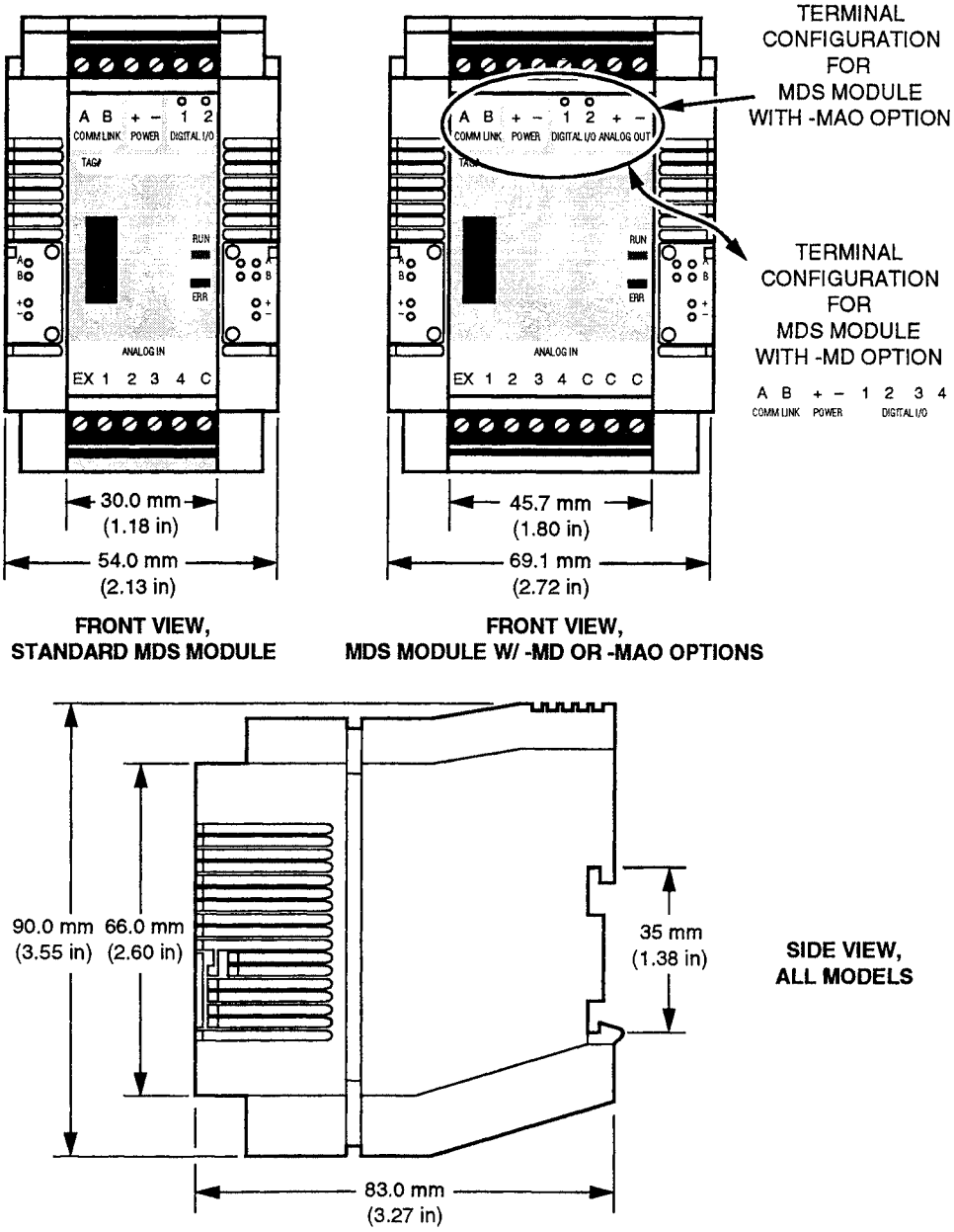
Installation — Physical Mounting

Once a module has been configured and tested, it can be physically mounted in an application. Do not install any units until they have been set up, or at least until they have had their settings checked and, if possible, documented.

MDS modules snap on to 35mm, DIN-style Top Hat mounting rail (EN50022). Contact your Moore Industries Sales Representative for information on G-rail adapters, enclosures, and cabinets.

Figure 48 gives the MDS module dimensions and terminal designations.

Figure 48. *The MDS Modules' Physical Dimensions*



Installation — Hookup for a Stand-Alone Module

It is not always necessary for an MDS module to be hooked up to a Host, or for it to be employed in a multi-module application for proper module function. Certain configurations enable it to act as a stand-alone module.

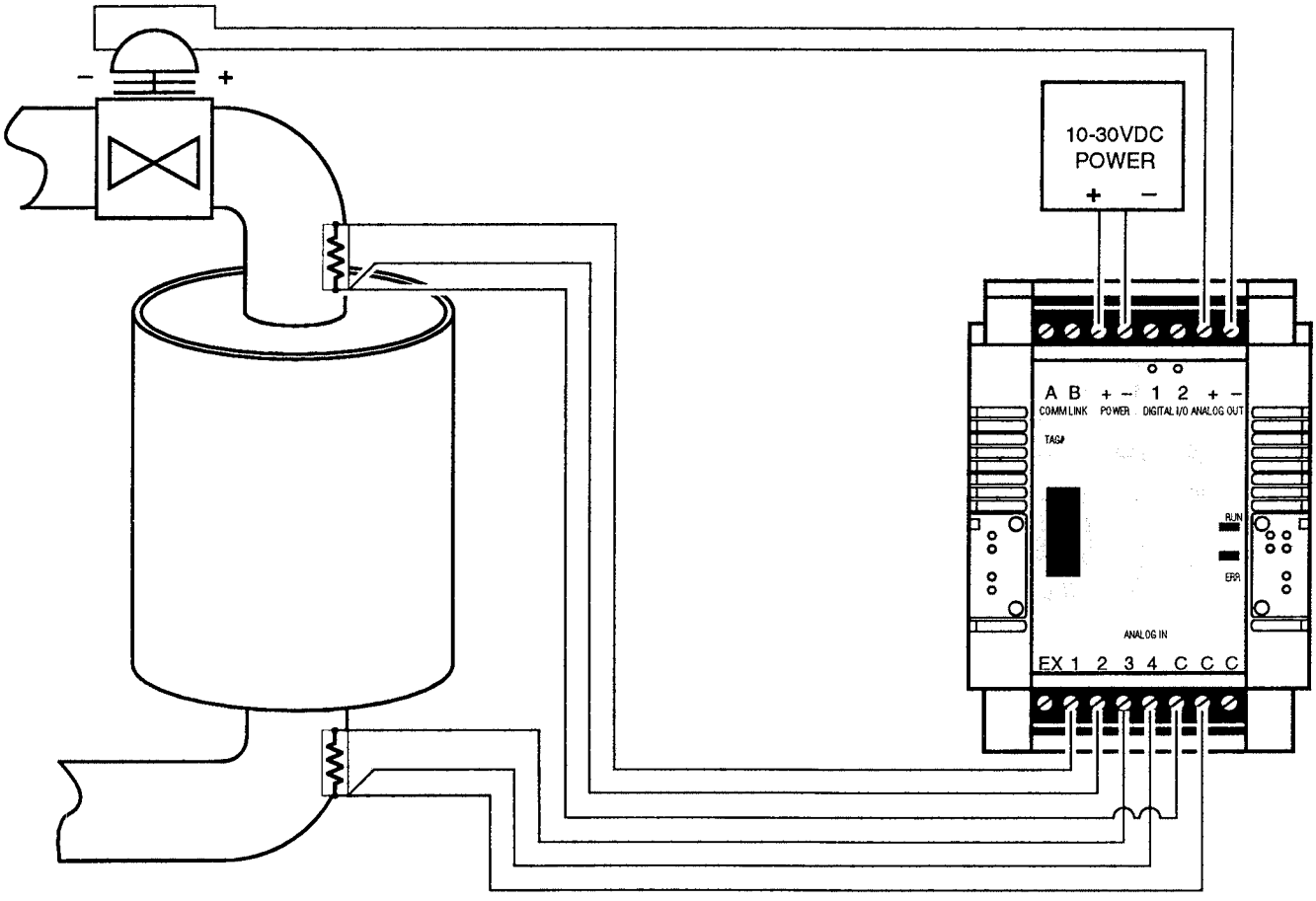
For example, Figure 49 shows the hookup for a module configured to:

- Compare the inputs from two RTDs on a heat-exchanger
- Provide a proportional analog output to a valve actuator based on the difference between the RTD readings

What constitute "appropriate" hookups for any MDS module depend entirely upon the I/O configuration in the module's application. As always, Moore Industries' team of highly skilled engineers and technicians can answer questions about this, and other applications, and can even provide help in building a Configuration File.

The next section of this manual consists of hookup diagrams for the various types of input and output accommodated by the ***I/O EQUATION STATION*** family of modules.

Figure 49. *Example — Hooking up a Stand-Alone MDS Module*



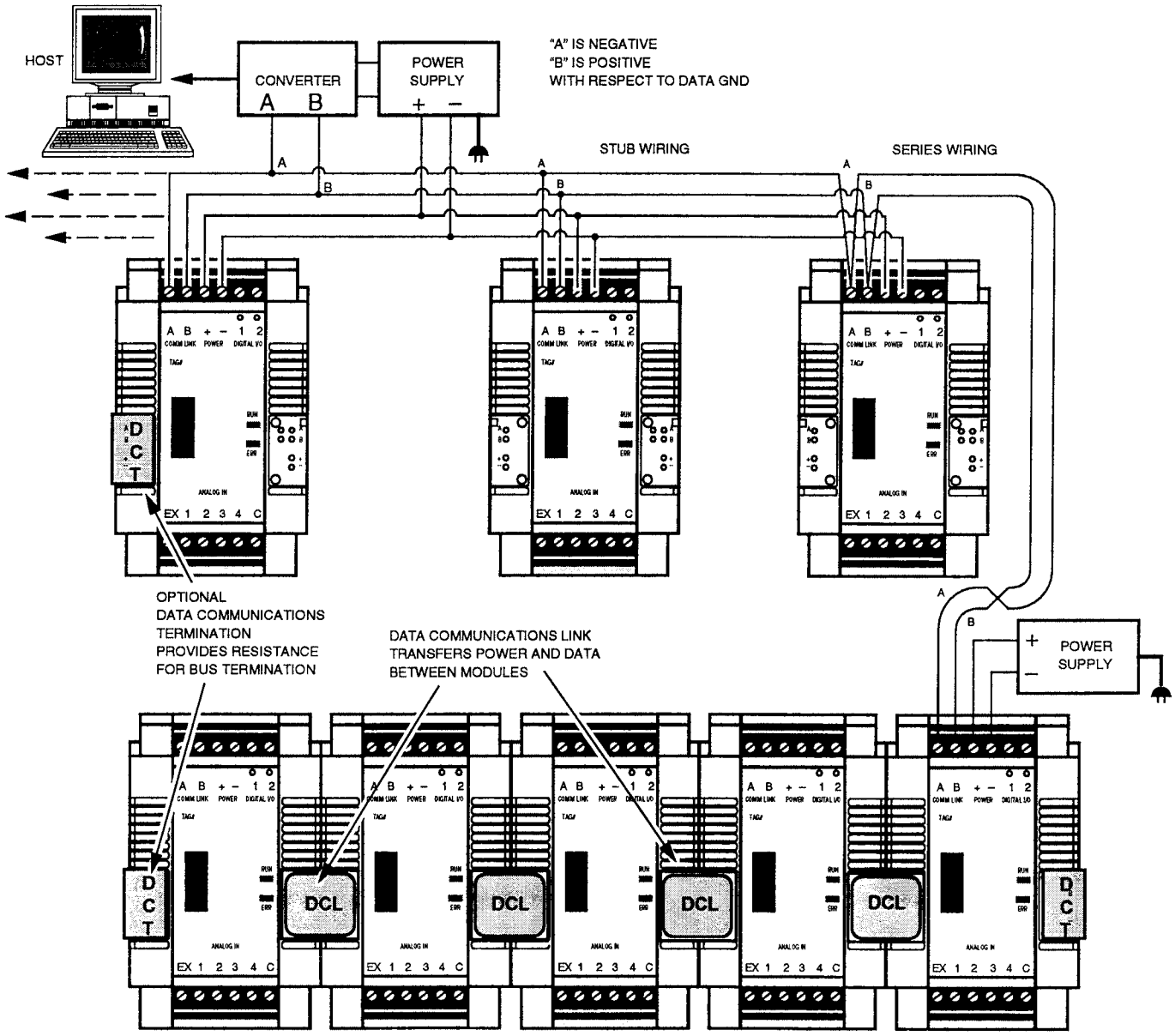
Installation — I/O, Power, and Comm Link Connections

Figure 50 shows the connections for power Comm Link, as well as the interconnection of several MDS modules in an ***I/O EQUATION STATION***.

Note that modules may be either stub cabled to the Comm Link, or connected in series. Use caution with series connections, as whenever one of the modules is removed, the entire Link will be disabled.

NOTE:
Limit stub cabling to 12 inches (30 cm).

Figure 50. *Connecting Multiple MDS Modules Together in an* ***I/O EQUATION STATION***



Moore Industries' DCL and DCT Data Communications Link and Termination accessories provide a convenient alternative to the direct wiring shown in Figure 50. Additionally, the DCT provides the recommended bus terminating resistance.

Moore Industries' Link Converter Module (LCM) can be used to adapt the ***I/O EQUATION STATION***s RS-485 communications signals to the RS-232 port available in most PCs.

Grounding

Moore Industries provides the following guidelines as a means to adherence with requirements set forth in EMC Directive 89/336/EEC, standards EN50082-2, 1995 (Generic Immunity); and EN50081-2, 1993 (Generic Emissions).

- All MDS modules must be mounted on earth-grounded (safety-grounded) DIN rail
- Twisted, shielded wiring must be used for all inputs and outputs. Shielding is to be grounded at the module (to earth or safety ground)
- The length of any non-shielded portions of input or output wiring is to be limited to 2 inches

All three types of MDS module have a labeled grounding lug on the bottom of the case. Use this lug in meeting the specifications above.

Summary of Diagrams

The connections between input and/or output devices and an MDS module depend upon the type of device, and how it is used in the module configuration.

Here is a summary of the diagrams:

- Figure 51 shows the connections for Voltage inputs, both single-ended and differential.
- Figure 52 shows the connections for Current inputs.
- Figure 53 shows the connections for 2-, 3-, or 4-wire RTD inputs.
- Figure 54 shows the connections for Thermocouple inputs, with both internal cold junction compensation (-ICJ option required), and external compensation.
- Figure 55 shows the connections for both 4- and 6-wire Resistance (Wheatstone) Bridge inputs.
- Figure 56 shows the connections for Potentiometer inputs.
- Figure 57 shows the connections for all Digital inputs.
- Figure 58 shows the circuit diagram for all types of Digital Inputs.
- Figure 59 shows the signal diagram for all types of Digital Counter inputs.
- Figure 60 shows the connections for Digital outputs.
- Figure 61 shows the circuit diagram for Digital outputs.
- Figure 62 shows the connections for the Analog output available with the -MAO option.

Figure 51. *Connecting Voltage Inputs to an MDS Module*

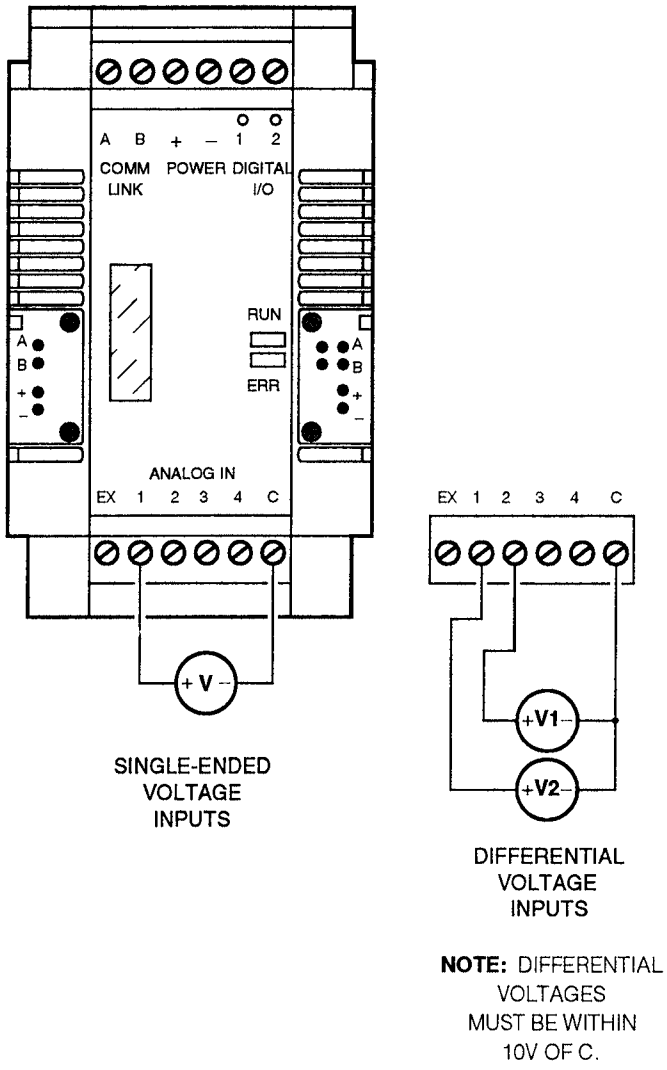


Figure 52. *Connecting Current Inputs to an MDS Module*

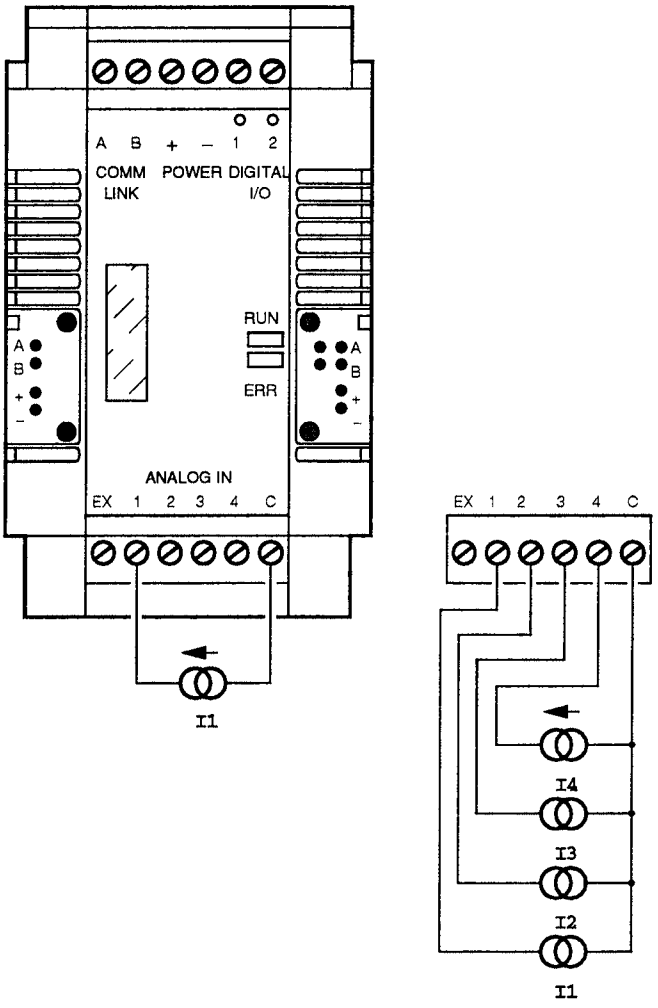


Figure 53. *Connecting 2-, 3-, or 4-Wire Resistance or RTD Inputs to an MDS Module*

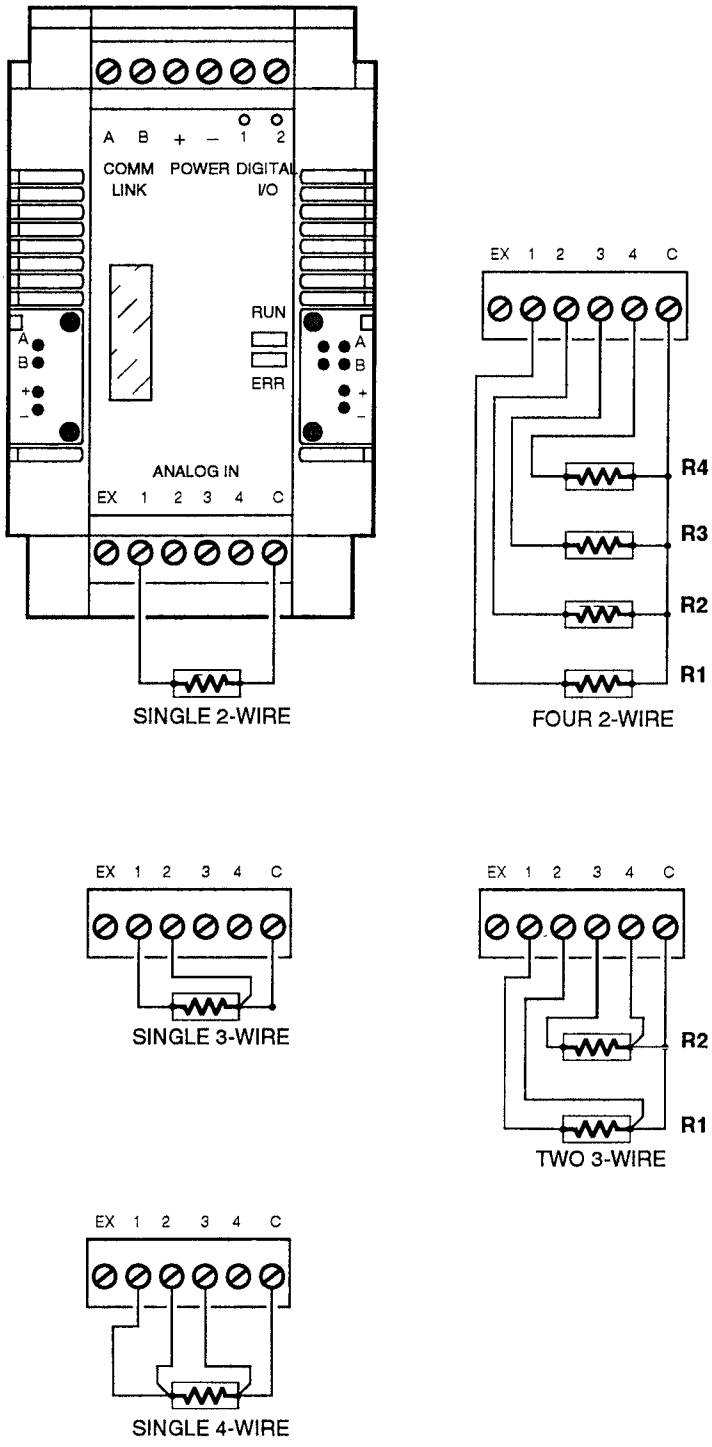


Figure 54. *Connecting Thermocouple Inputs to an MDS Module*

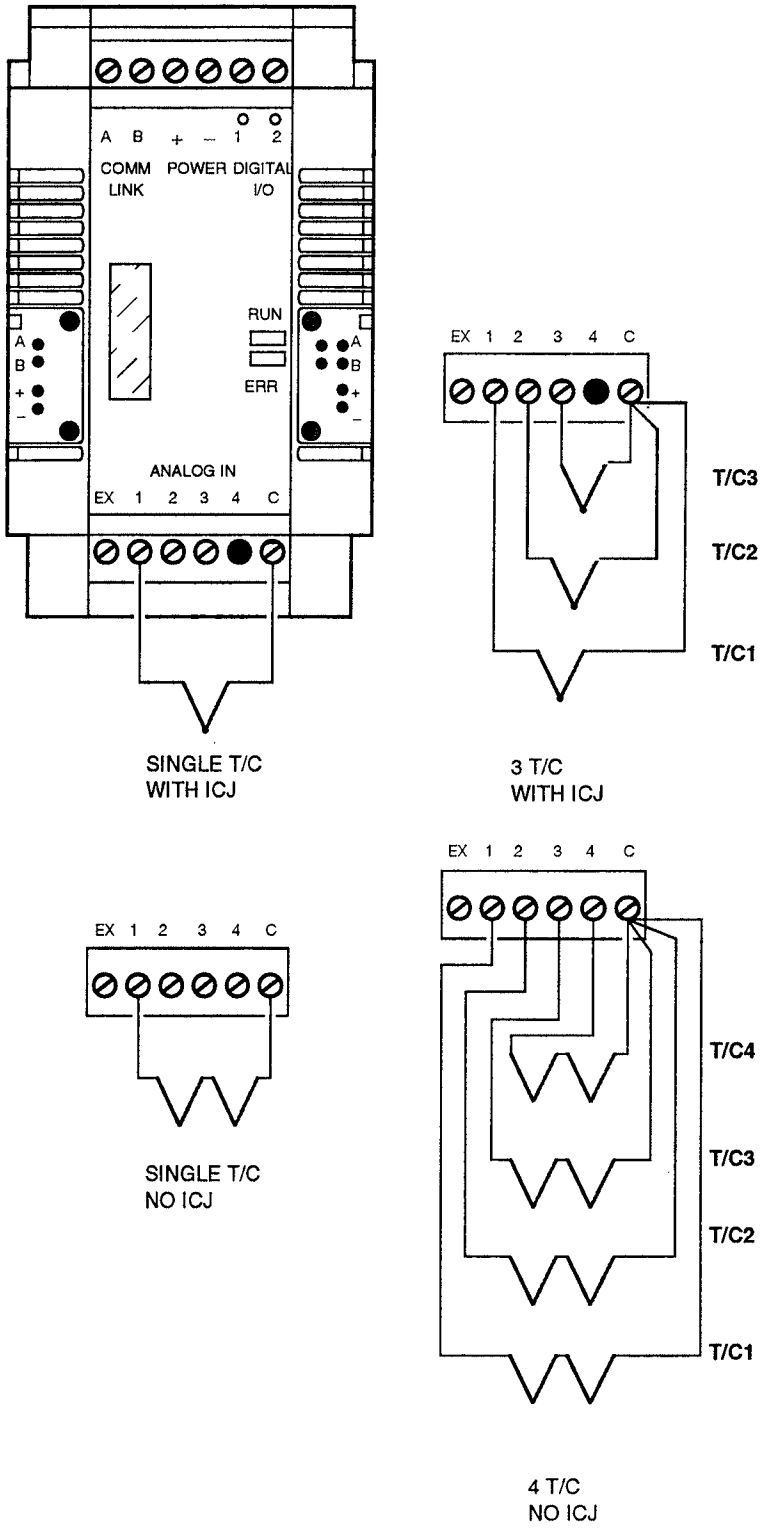


Figure 55. *Connecting Wheatstone Bridge (Strain Gauge) Inputs to an MDS Module*

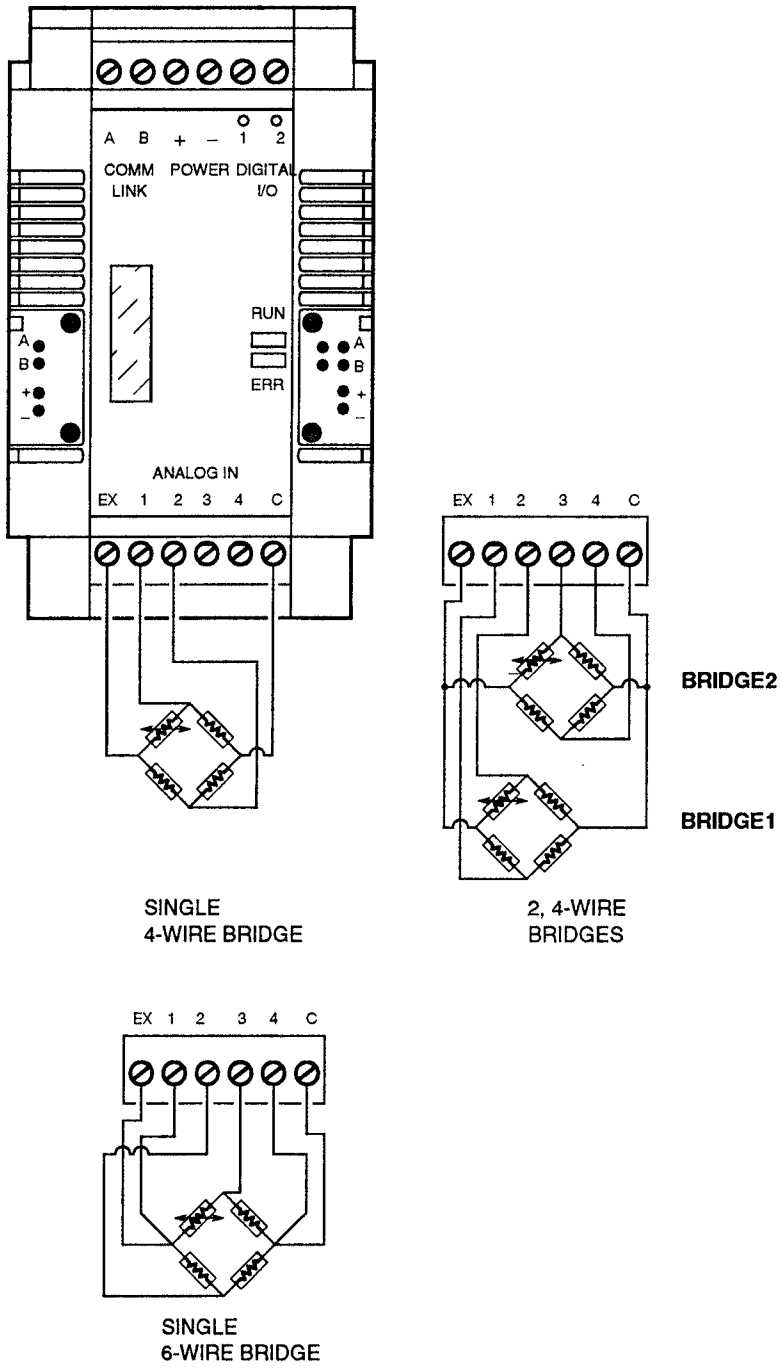
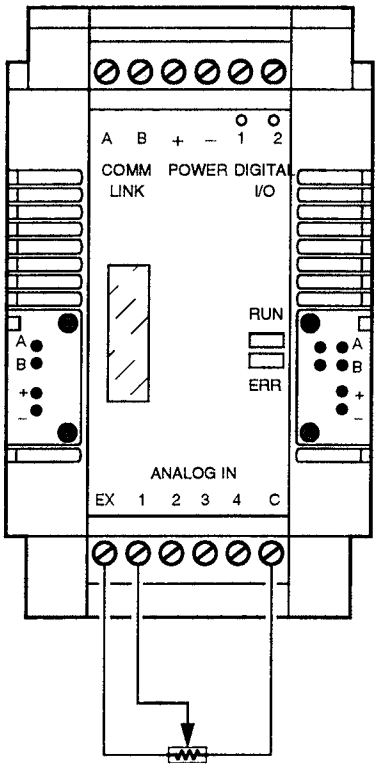
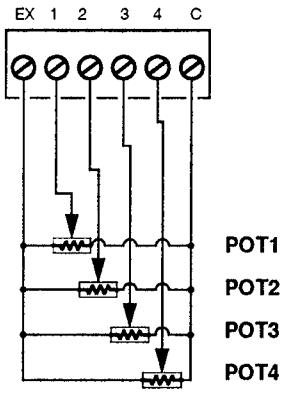


Figure 56. *Connecting Potentiometer Inputs to an MDS Module*



SINGLE
3-WIRE
POTENTIOMETER



4, 3-WIRE
POTENTIOMETERS

Figure 57. *Connecting Digital Inputs to an MDS Module*

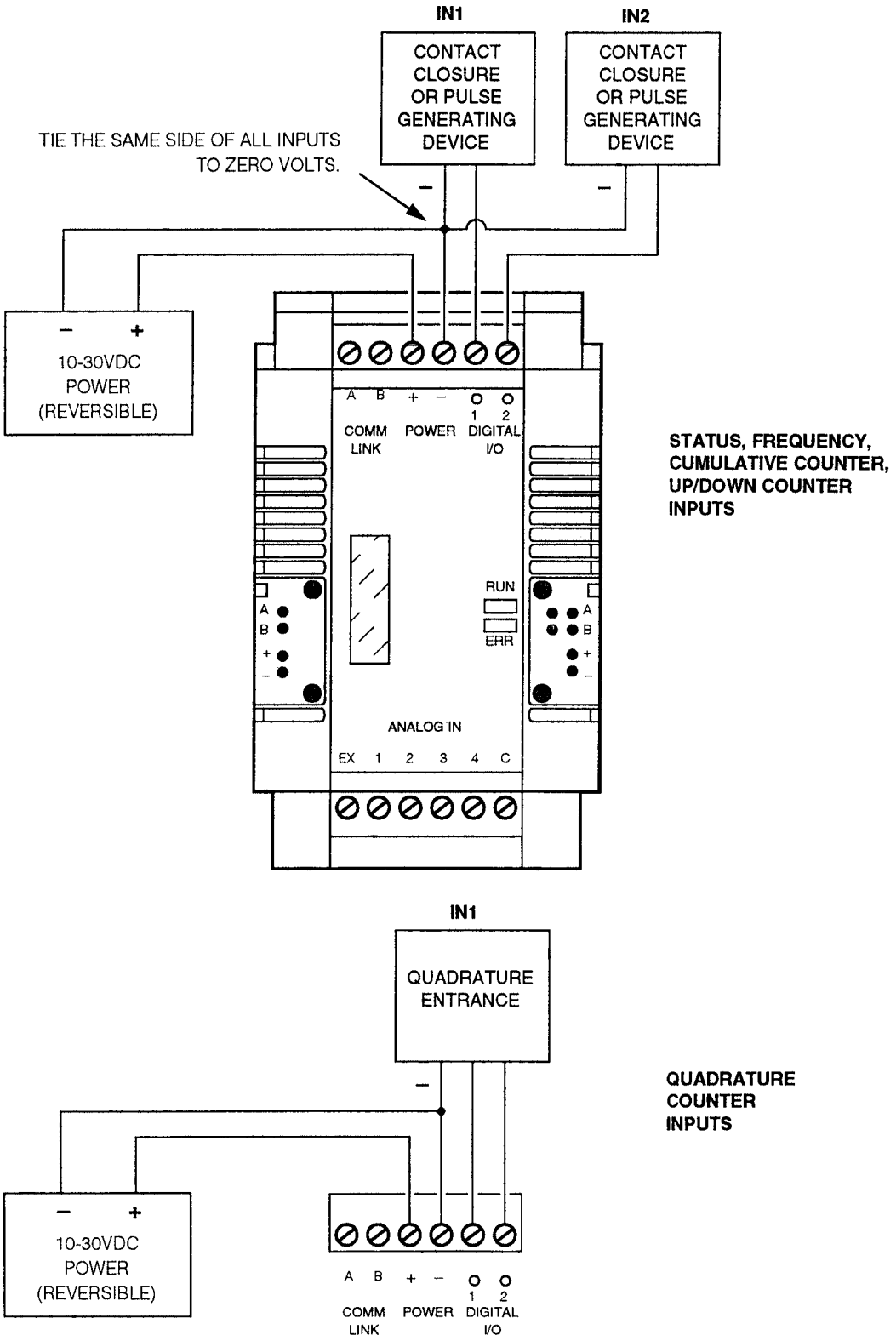


Figure 58. *Examining the Circuitry for Digital Inputs to an MDS Module*

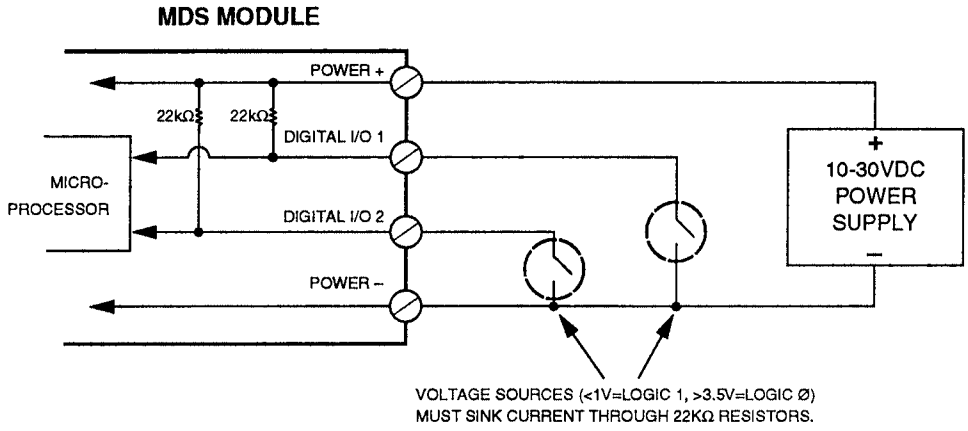


Figure 59. *Examining the Signals Logic for Digital Inputs to an MDS Module*

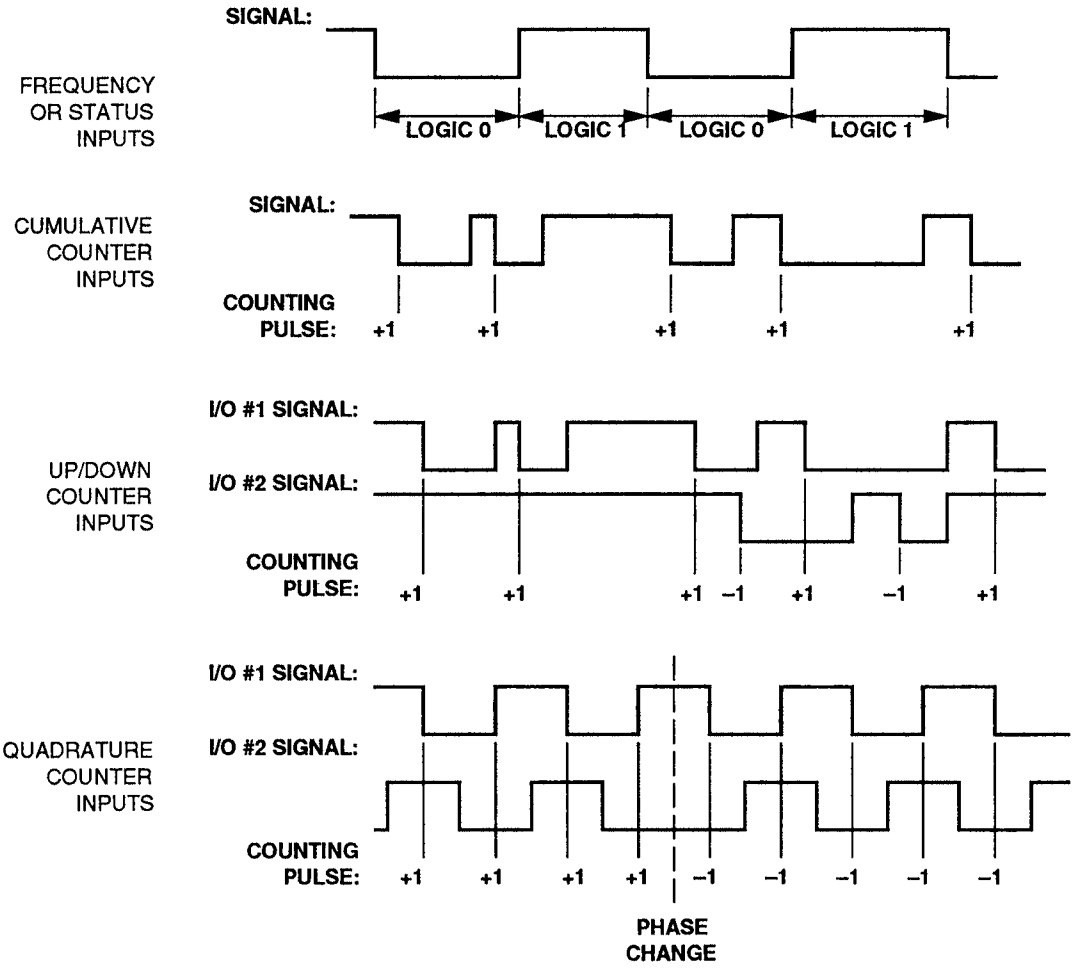


Figure 60. *Connecting Field Devices to the Digital Outputs of an MDS Module*

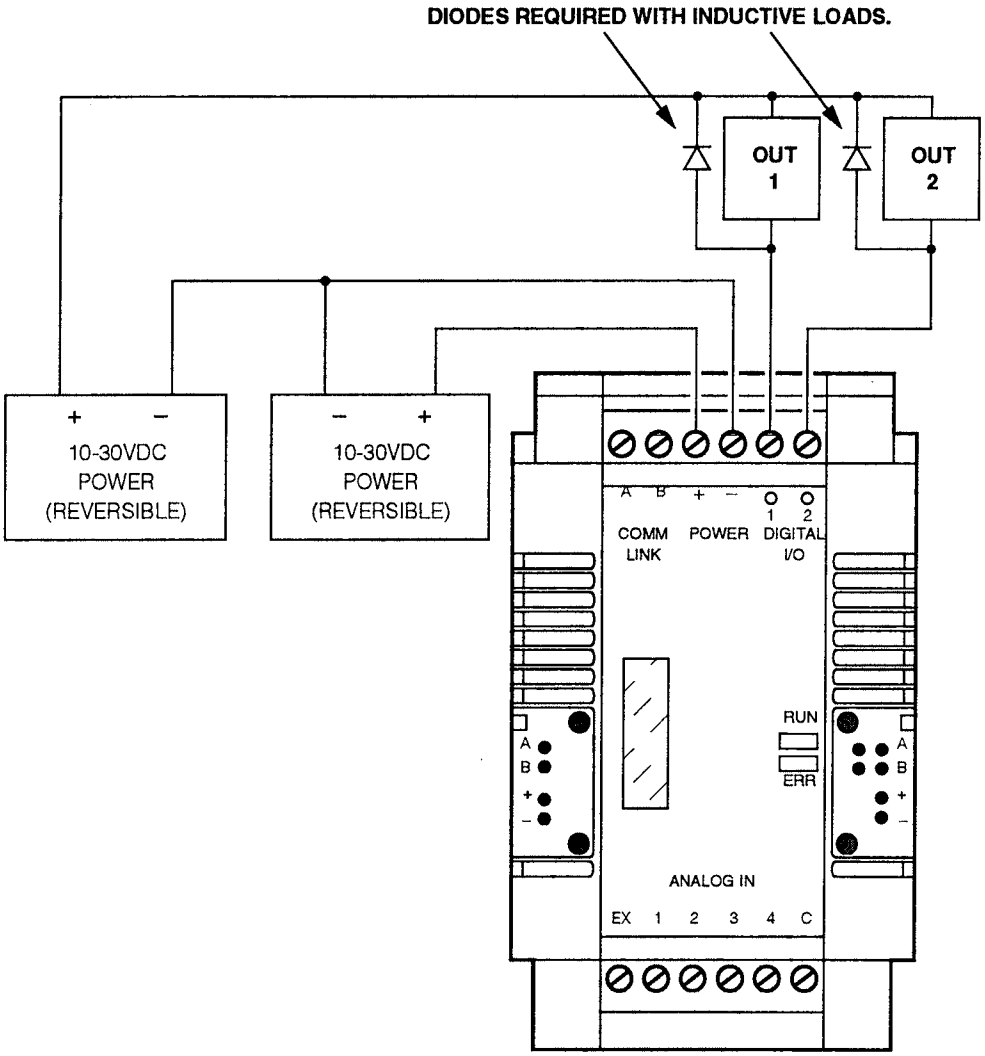


Figure 61. *Examining the Circuitry for Digital Outputs from an MDS Module*

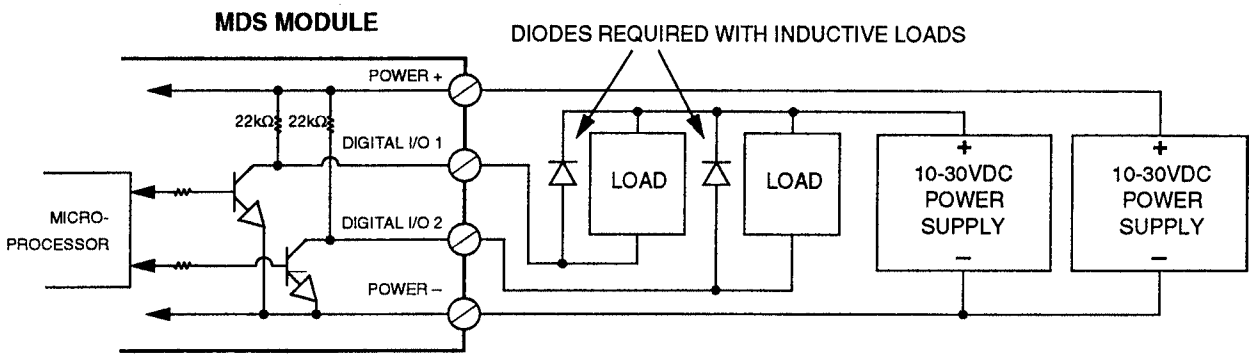
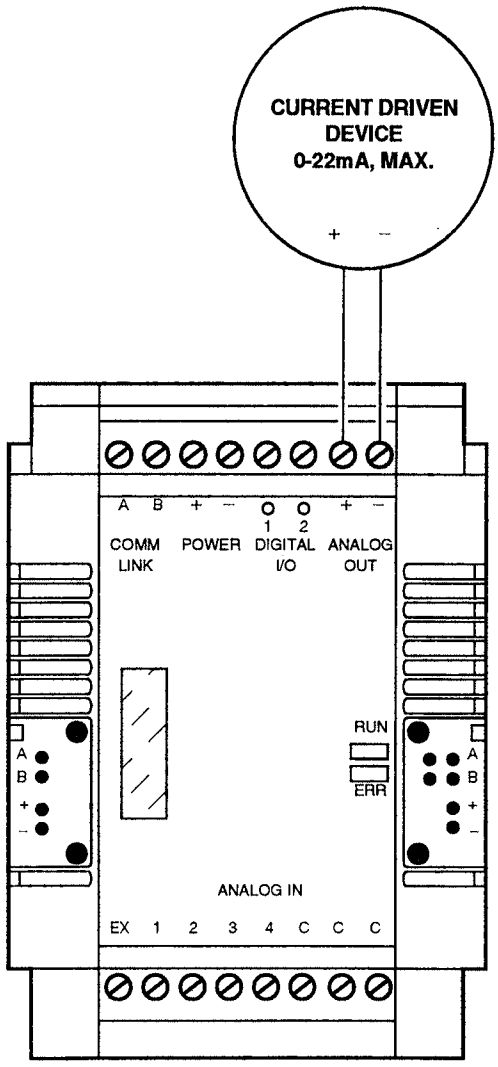


Figure 62. *Connecting Field Devices to the Analog Output of an MDS Module*



Operation

Once configured correctly, supplied with power, and inter-connected using the illustrations in this manual as a guide, ***I/O EQUATION STATION*** modules are ready to begin processing transactions from and for the System Host.

LEDs

There are two LEDs on the front panel of every type of MDS module. These can provide a quick indication of any communications or range errors/problems.

Table 7 summarizes the function of the LEDs.

Table 7. *Deciphering the MDS Module Front Panel LED Status*

RUN LED (green)	ERR LED (red)	Meaning
ON	OFF	Power and Comm Link are connected properly. No commands are being received. No data is being transmitted.
FLASH	OFF	Data is being transmitted from the MDS module over the Data Comm Link.
OFF	n/a	Power is incorrectly connected or does not meet supply voltage requirements.
ON	FLASH	The MDS module is in its Monitor Mode. A valid communications protocol must be downloaded.
ON or FLASH	ON	The MDS module is processing a signal outside the configured range. This could be due to sensor failure, incorrect configuration, or out of range input.

Communications — Using the MODBUS RTU Protocol

This section of the manual gives an overview of the MODBUS RTU query/response format used by MDS modules during operation. Use the information is section to set up the Host MMI, SCADA, or DCS software to correctly process the data provided by the module(s) during operation.

NOTE:
*The PROFIBUS/ASCII protocol supported by the **I/O EQUATION STATION** is set up according to the DIN19245 specification, part 1.*

For information on this protocol and how it works with MDS modules, consult the factory.

MODBUS RTU ("RTU" for Remote Terminal Unit) is a communications "language" originally developed (by Modicon, Inc.) for use by industrial controllers in sending process data between points on the factory floor. The reliability and relative ease-of-use of MODBUS RTU resulted in its adoption as the *de facto* standard protocol in many sectors of the process control industry, both by software developers and by hardware manufacturers.

Because Moore Industries MDS modules "speak" the MODBUS RTU "language", they are compatible with many of today's most popular and powerful DCS, SCADA, and MMI software packages and equipment.

Contact the factory for information on the availability of third-party software drivers, and complete, turn-key ***I/O EQUATION STATION*** systems of MDS modules, transmitters, enclosures, wiring, software, installation, and maintenance.

MODBUS Terminology

Transaction – A formatted packet of data, consisting of a query and a response, used in MODBUS to send information over the Comm Link. Figure 63 represents the MODBUS RTU transaction cycle graphically. Table 8 shows how the parts of a query or a response are actually formatted.

Query – The part of a MODBUS transaction that is originated by the Host.

Response – The part of a MODBUS transaction that is originated by the module addressed in a query.

(Definitions of MODBUS Terms continue...)

EQUATION STATION

Figure 63. *Graphically Representing a MODBUS RTU Transaction*

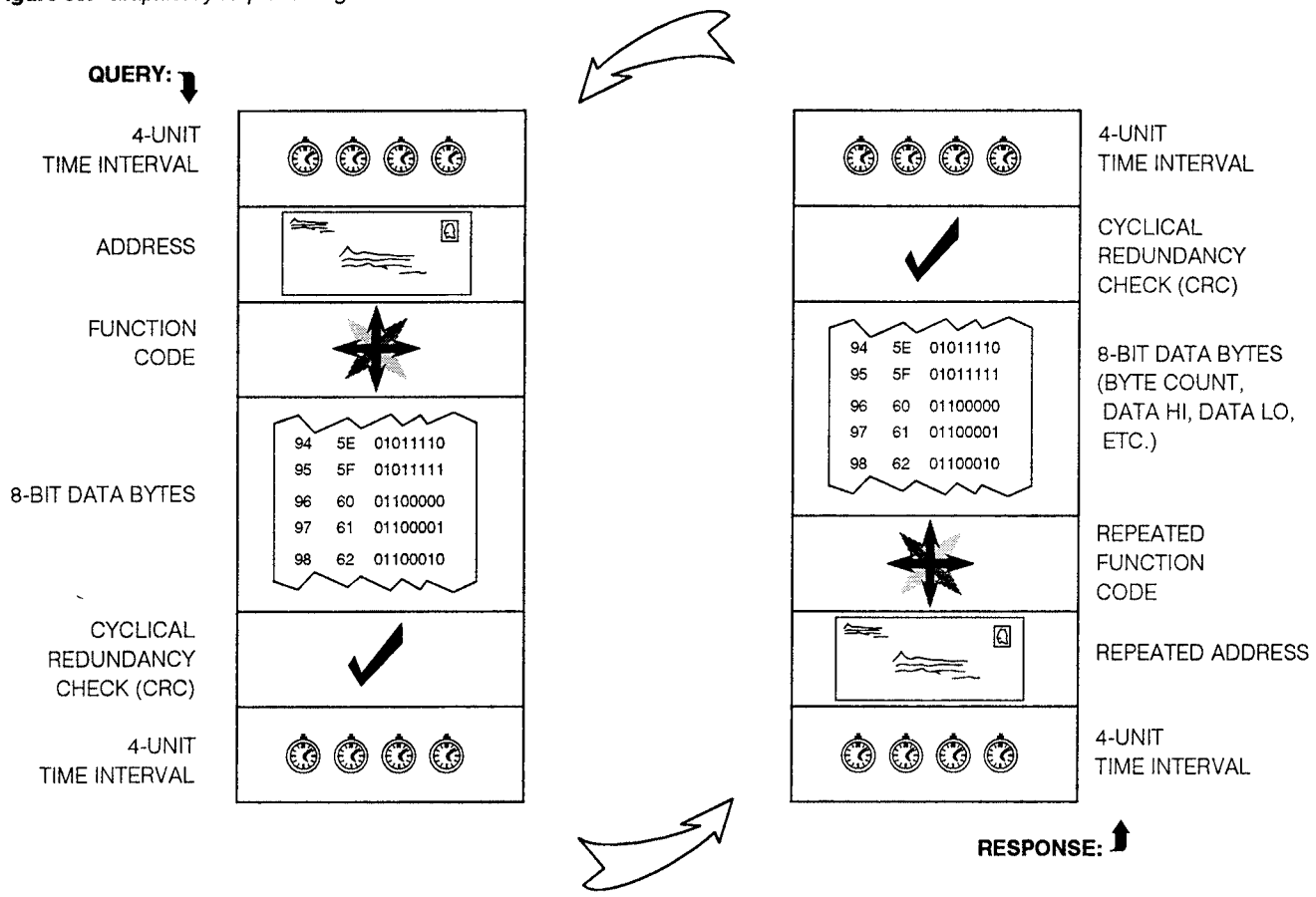


Table 8. *Formatting a MODBUS Query/Response*

START	ADDRESS	FUNCTION	DATA	CRC	END
T1 - T2 - T3 - T4	8 BITS	8 BITS	*n*(8 BITS)	16 BITS	T1 - T2 - T3 - T4
	06 (hex)	03 (hex)	00 6B 00 03 (hex)	CRC	
	0000 0110	0000 0011	0000 0000 0110 1011 0000 0000 0000 0011		

(...continued from preceding page.)

Address – The module designator in a transaction. Every query and response must include an address field. The valid address codes are between 001 and 127. Refer to page 67 for instructions on setting an MDS module address.

Function Code – The part of a MODBUS transaction that tells the addressed module what to do. Table 9 lists the MODBUS codes implemented in the ***I/O EQUATION STATION.***

Error Check – A cyclical redundancy check (CRC).

Time Interval, T1 - T4 Every query and response starts with an interval of communications silence of a minimum of 3.5 character times at the Data Link baud rate setting. Refer to page 71 for instructions on setting a module's communications time-out parameter.

NOTE:

Once a MODBUS transaction is begun, the query/response stream must not be interrupted for longer than 3.5 character intervals (at the baud rate setting). If the transaction is interrupted, all devices on the Data Link flush the incomplete message and assume that the next two characters are part of some address, inevitably leading to a communications error.

Only the addressed module interprets the message-ending silence gap as the message ender. All other devices on the Data Link assume that the gap is the start of a valid query, and therefore begin to "listen" for their address (in the next two characters).

In this fashion, MODBUS traffic can be a continuous stream of data interrupted by 3.5- to-4-character intervals of silence.

(Definitions of MODBUS Terms continue...)

Table 9. *Summarizing the MODBUS RTU Function Codes Implemented in MDS Modules*

Function Code	MODBUS Function	MDS Implementation
03	**Read All Input Registers**	Read the binary contents of all variables on the addressed module
04	**Read All Holding Registers**	
06	**Preset (Write) Single Holding Register (Output)**	Set/change the state or level of one particular output variable on the addressed module
08	**Diagnostic (Loop Back)**	Check for the presence and functioning of the addressed module on the Comm Link
16	**Write Multiple Holding Registers (Outputs)**	Set/change the state or level of all the output variables on the addressed module

(...continued from the preceding page.)

Data This is a variable-length field that includes, where appropriate, a byte count, number of channels to be read, the actual data, etc. This field is discussed in greater detail in the next section.

Data — Physical Registers

In the MDS module, both configuration data and process I/O information is stored in specific, numbered locations in memory. These locations are called "*physical registers*". The Function Codes, when part of a properly formatted query, are used to read back the contents of these physical registers, and to write values to them.

All MDS module data (both configuration and process I/O) can be read (using an MMI or SCADA program, or with the "Measure" utility in the Configuration program) in either of the physical registers numbered 30*x* or 40*x* (the MDS stores the same data in both of the registers).

The 30*x* series are Input Registers, 40*x* are Holding registers. Data can be read from either, but must be written to 40*x*.

Both registers are comprise a series of non-zero integers. Therefore, to read the value in physical register 0000, the actual physical register that is addressed must be either 300001 or 400001. To write a value to this same physical register, only 400001 can be used.

Table 10 constitutes a "map" of the physical registers used by the MDS module. For clarity, the "30" and "40" prefixes are left off of the values in the table. Note that it includes those registers that are only available when the unit is equipped with either the -MD or -MAO options.

MDS MODBUS Data Format

An MDS module reserves 2 locations in its database for the I/O data from each Variable. As is shown in Table 10, the Integer Value is stored in addresses 0000 through 000F, and the Real, or Floating Point value is stored in addresses 0010 through 002F.

When the Integer, or Actual Value physical register is read, the value in the register is returned without a decimal. The interpretation of the value therefore depends upon how the "`Format`" field of the module's Configuration File is set (page 45 has the instructions for setting the "`Format`" field). The Format setting resides in physical registers 0082 and 0083 for Variable 1, 00A2 and 00A3 for Variable 2, 00C2 and 00C3 for Variable 3, etc. (see Table 10).

The "`Format`" field in the Configuration File consists of two parameters, a length of field and a decimal position. Up to 8 significant digits may be specified for the length of field parameter, and the decimal position value is the number of digits that read back to the right of the decimal place.

When reading the Integer or Actual Value register, use the following formula to interpret the returned value. The "Raw Value" is the number returned. "*d*" is the number of places to the right of the decimal (also from Format).

$$\text{Actual Value} = \text{Raw Value} \div 10^{d}$$

The range of the Actual Value is from 0 to 65535 if unsigned, from –32768 to +32767 if signed.

When reading the Real, or Floating Point Value physical register (IEEE Single Precision, 4-byte Real Format), the read function actually accesses 2 locations in the register, word and address. Therefore, no special considerations need to be made for the decimal point.

(continues...)

Table 10. *Mapping the MDS Module MODBUS Physical Registers*

Variables in Integer Format		
Physical Register Address	**Content**	**Numerical Range**
0000	Variable 1	16-Bit Unsigned Integer
0001	Variable 2	"
0002	Variable 3	"
0003	Variable 4	"
⇕	⇕	"
000F	Variable 16	"
Variables in IEEE, 4-byte Floating Point Format (STD 754-1985)		
Physical Register Address	**Content**	**Numerical Range**
0010	Variable 1, High Word	16-Bit Unsigned Integer
0011	Variable 1, Low Word	"
0012	Variable 2, High Word	"
0013	Variable 2, Low Word	"
0014	Variable 3, High Word	"
0015	Variable 3, Low Word	"
⇕	⇕	"
002E	Variable 16, High Word	"
002F	Variable 16, Low Word	"
Module Configuration		
Physical Register Address	**Parameter**	**Setting**
0080	Variable 1 Type	0 = Empty 1 = Analog Input 2 = Arithmetic 3 = Digital Output 4 = Digital Input 5 = Setpoint 6 = Alarm 7 = Analog Output

(Table continues next page...)

Table 10 (continued). *Mapping the MDS Module MODBUS Physical Registers*

Module Configuration (continued)		
Physical Register Address	**Parameter**	**Setting**
0081	Variable 1 Measurement Type	Digital Input: 0 = None 1 = Digital Status 2 = Frequency Measurement 3 = Cumulative Counter 4 = Quadrature Counter 5 = Up-Down Counter Digital Output: 0 = None 1 = Host Controlled 2 = Pulse Width Modulated 3 = Process Controlled Analog Input: 0 = Voltage, Single-ended 1 = Voltage, Differential 2 = Current 3 = RTD, 2-wire 4 = RTD, 3-wire 5 = RTD, 4-wire 6 = Bridge, 4-wire 7 = Bridge, 6-wire 8 = Thermocouple, Internally Compensated 9 = Thermocouple, Externally Compensated 10 = Cold Junction Compensation, 1 channel 11 = Potentiometer 12 = Cold Junction Compensation, 2 channel 13 = Cold Junction Compensation, 3 channel 14 = Cold Junction Compensation, 4 channel
0082	Variable 1, Format - Length	1 to 8
0083	Variable 1, Format - Decimal Position	0 to 6 places
0084	Variable 1 Zero Calibration	0 = None 1 = Adjusted
0085 - 0086	Variable 1, Format - Units	4 ASCII Characters
0087 - 0090	Variable 1 Name	20 ASCII Characters
0091 - 009F	Reserved	–
00A0	Variable 2 Type	Same as for Variable 1
00A1	Variable 2 Measurement Type	"
00A2	Variable 2, Format - Length	"
00A3	Variable 2, Format - Decimal Position	"
00A4	Variable 2 Zero Calibration	"
00A5 - 00A6	Variable 2, Format - Units	"
00A7 - 00B0	Variable 2 Name	"

(Table continues next page...)

Table 10 (continued). *Mapping the MDS Module MODBUS Physical Registers*

Module Configuration (continued)		
Physical Register Address	**Parameter**	**Setting**
00B1 - 00BF	Reserved	–
⇳	⇳	Same as for Variable 1
0260	Variable 16 Type	*
0261	Variable 16 Measurement Type	*
0262	Variable 16, Format - Length	*
0263	Variable 16, Format - Decimal Position	*
0264	Variable 16 Zero Calibration	*
0265 - 0266	Variable 16, Format - Units	*
0267 - 0270	Variable 16 Name	*
0271 - 027F	Reserved	–
0300	Number of Variables	Integer from 1 to 16
0301 - 0303	Module Serial Number	6 ASCII Characters
0304 - 030D	Module Name	20 ASCII Characters
0400 - 0403	Product Name	8 ASCII Characters
0404 - 0407	Device Type (Options Installed)	*
0408 - 040B	Hardware Version	*
040C - 040F	Software Version	*
Error Flags		
0500	Module Status	Bit 0 = EEPROM Failure Bit 1 = FLASH Memory Failure Bit 2 = A-D Converter Failure Bit 3 = Configuration Failure Bit 4 - Bit 15 Not Used
0501	Range Error	Bit 0 = Channel 1 Range Error Bit 1 = Channel 2 Range Error Bit 2 = Channel 3 Range Error ⇳ Bit 16 = Channel 15 Range Error

(...from preceding page.)

MDS MODBUS Resets and Digital Writes

Some MDS variables, such as counters and arithmetic integrators have a reset component. To reset these variables, write a zero to the holding register for the variable using the 06 Function code.

Digital Output variables can also be set in the same manner; writing zeroes or ones to the appropriate physical register.

CRC

The cyclical redundancy check is computed as follows:

1. **Load a 16-bit CRC register with 1s (FFFFhex).**
2. **Exclusive OR the first 8-bit byte of the message with the low-order byte of the CRC register loaded in Step 1, putting the result in the CRC register.**
3. **Shift the CRC register one bit to the right (toward the least significant bit), filling the most significant bit with zeroes.**
4. **Examine the least significant bit of the new value derived in Step 3.**

   If 0, GO TO Step 3.

   If 1, Exclusive OR the CRC register with the value "1010 0000 0000 0001" (A001hex).
5. **Repeat Steps 3 and 4 until 8 shifts have been performed.**
6. **Repeat Steps 2 through 5 with the second 8-bit byte of the message.**

   The final contents of the CRC register are the CRC value to be appended to the MDS module MODBUS RTU query.

NOTE:
When appending the CRC to a query, add the low-order byte first, followed by the high-order byte.

The following BASIC program listing that computes CRCs. Contact the factory for a Visual BASIC copy of this program.

```
Function addcrc (strtocrc As String) As String
Rem Step 1
    crc& = 65535
    i = 1
    Do
      inchar& = Asc(Mid$(strtocrc, i, 1))
Rem Step 2
    crc& = (crc& Xor inchar&)
    j = 0
    Do
      j = j + 1
Rem Step 3
    lsb = crc& Mod 2
    crc& = crc& \ 2
Rem Step 4
    If (lsb = 1) Then
      crc& = (crc& Xor 40961)
      Rem (A001hex)
      End If
Rem Step 5
    Loop Until j = 8
    i = i + 1
Rem Step 6
    Loop Unit i > Len(strtocrc)
    Rem Extract CRC as 2 characters
    c2$ = Chr$(crc& Mod 256)
    Rem Lo-order Byte
c1$ = Chr$(crc& \ 256)
Rem Hi-order Byte
addcrc = strtocrc & c2$ & c1$
End Function
```

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Table 11. Decimal-to-Hex-to-Binary-to-ASCII Conversion

D	H	B	A	D	H	B	A	D	H	B	A	D	H	B	A	D	H	B	D	H	B
0	00	0000 0000		41	29	00101001	)	82	52	01010010	R	123	7B	01111011	{	164	A4	10100100	205	CD	11001101	246	F6	11110110
1	01	00000001		42	2A	00101010	*	83	53	01010011	S	124	7C	01111100	|	165	A5	10100101	206	CE	11001110	247	F7	11110111
2	02	00000010		43	2B	00101011	+	84	54	01010100	T	125	7D	01111101	}	166	A6	10100110	207	CF	11001111	248	F8	11111000
3	03	00000011		44	2C	00101100	,	85	55	01010101	U	126	7E	01111110	~	167	A7	10100111	208	D0	11010000	249	F9	11111001
4	04	00000100		45	2D	00101101	-	86	56	01010110	V	127	7F	01111111		168	A8	10101000	209	D1	11010001	250	FA	11111010
5	05	00000101		46	2E	00101110	.	87	57	01010111	W	128	80	10000000		169	A9	10101001	210	D2	11010010	251	FB	11111011
6	06	00000110		47	2F	00101111	/	88	58	01011000	X	129	81	10000001		170	AA	10101010	211	D3	11010011	252	FC	11111100
7	07	00000111		48	30	00110000	0	89	59	01011001	Y	130	82	10000010		171	AB	10101011	212	D4	11010100	253	FD	11111101
8	08	00001000		49	31	00110001	1	90	5A	01011010	Z	131	83	10000011		172	AC	10101100	213	D5	11010101	254	FE	11111110
9	09	00001001		50	32	00110010	2	91	5B	01011011	[	132	84	10000100		173	AD	10101101	214	D6	11010110	255	FF	11111111
10	0A	00001010		51	33	00110011	3	92	5C	01011100	\	133	85	10000101		174	AE	10101110	215	D7	11010111	256	100	100000000
11	0B	00001011		52	34	00110100	4	93	5D	01011101	]	134	86	10000110		175	AF	10101111	216	D8	11011000	257	101	100000001
12	0C	00001100		53	35	00110101	5	94	5E	01011110	^	135	87	10000111		176	B0	10110000	217	D9	11011001	258	102	100000010
13	0D	00001101		54	36	00110110	6	95	5F	01011111	—	136	88	10001000		177	B1	10110001	226	E2	11100010	259	103	100000011
14	0E	00001110		55	37	00110111	7	96	60	01100000	`	137	89	10001001		178	B2	10110010	227	E3	11100011	260	104	100000100
15	0F	00001111		56	38	00111000	8	97	61	01100001	a	138	8A	10001010		179	B3	10110011	228	E4	11100100	261	105	100000101
16	10	00010000		57	39	00111001	9	98	62	01100010	b	139	8B	10001011		180	B4	10110100	229	E5	11100101	etc.	etc.	etc.
17	11	00010001		58	3A	00111010	:	99	63	01100011	c	140	8C	10001100		181	B5	10110101	230	E6	11100110	•	•	•
18	12	00010010		59	3B	00111011	;	100	64	01100100	d	141	8D	10001101		182	B6	10110110	231	E7	11100111	•	•	•
19	13	00010011		60	3C	00111100	<	101	65	01100101	e	142	8E	10001110		183	B7	10110111	232	E8	11101000	•	•	•
20	14	00010100		61	3D	00111101	=	102	66	01100110	f	143	8F	10001111		184	B8	10111000	218	DA	11011010	•	•	•
21	15	00010101		62	3E	00111110	>	103	67	01100111	g	144	90	10010000		185	B9	10111001	219	DB	11011011	•	•	•
22	16	00010110		63	3F	00111111	?	104	68	01101000	h	145	91	10010001		186	BA	10111010	220	DC	11011100	•	•	•
23	17	00010111		64	40	01000000	@	105	69	01101001	i	146	92	10010010		187	BB	10111011	221	DD	11011101	•	•	•
24	18	00011000		65	41	01000001	A	106	6A	01101010	j	147	93	10010011		188	BC	10111100	222	DE	11011110	•	•	•
25	19	00011001		66	42	01000010	B	107	6B	01101011	k	148	94	10010100		189	BD	10111101	223	DF	11011111	•	•	•
26	1A	00011010		67	43	01000011	C	108	6C	01101100	l	149	95	10010101		190	BE	10111110	224	E0	11100000	•	•	•
27	1B	00011011		68	44	01000100	D	109	6D	01101101	m	150	96	10010110		191	BF	10111111	225	E1	11100001	•	•	•
28	1C	00011100		69	45	01000101	E	110	6E	01101110	n	151	97	10010111		192	C0	11000000	233	E9	11101001	•	•	•
29	1D	00011101		70	46	01000110	F	111	6F	01101111	o	152	98	10011000		193	C1	11000001	234	EA	11101010	•	•	•
30	1E	00011110		71	47	01000111	G	112	70	01110000	p	153	99	10011001		194	C2	11000010	235	EB	11101011	•	•	•
31	1F	00011111		72	48	01001000	H	113	71	01110001	q	154	9A	10011010		195	C3	11000011	236	EC	11101100	•	•	•
32	20	00100000		73	49	01001001	I	114	72	01110010	r	155	9B	10011011		196	C4	11000100	237	ED	11101101	•	•	•
33	21	00100001	!	74	4A	01001010	J	115	73	01110011	s	156	9C	10011100		197	C5	11000101	238	EE	11101110	•	•	•
34	22	00100010	"	75	4B	01001011	K	116	74	01110100	t	157	9D	10011101		198	C6	11000110	239	EF	11101111	•	•	•
35	23	00100011	#	76	4C	01001100	L	117	75	01110101	u	158	9E	10011110		199	C7	11000111	240	F0	11110000	4090	0FFA	•
36	24	00100100	$	77	4D	01001101	M	118	76	01110110	v	159	9F	10011111		200	C8	11001000	241	F1	11110001	4091	0FFB	•
37	25	00100101	%	78	4E	01001110	N	119	77	01110111	w	160	A0	10100000		201	C9	11001001	242	F2	11110010	4092	0FFC	•
38	26	00100110	&	79	4F	01001111	O	120	78	01111000	x	161	A1	10100001		202	CA	11001010	243	F3	11110011	4093	0FFD	•
39	27	00100111	'	80	50	01010000	P	121	79	01111001	y	162	A2	10100010		203	CB	11001011	244	F4	11110100	4094	0FFE	•
40	28	00101000	(	81	51	01010001	Q	122	7A	01111010	z	163	A3	10100011		204	CC	11001100	245	F5	11110101	4095	0FFF	•

D = Decimal Number H = Hexadecimal Number B = Binary Number A = ASCII = Unprintable

Index

Symbols

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no entries

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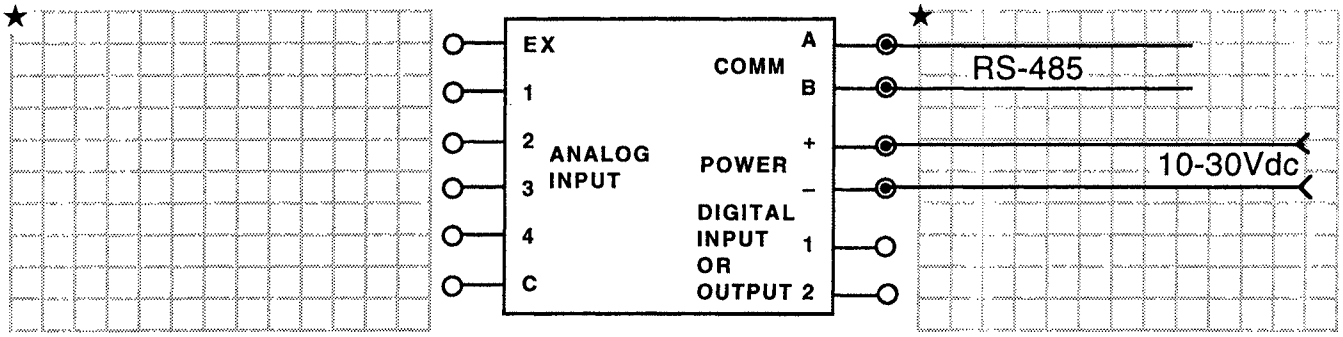
MDS Standard Module Configuration Form

INFORMATION IN ★'d FIELDS CAN BE SAVED IN MODULE CONFIGURATION FILE.

Customer/User Name (24 character max) ★	Date
Job Number	Line Item Number
Module Serial Number	Completed By
Configuration File Number **236-75B05-**_____	MDSCNFG.exe Version Number



Module Communications Address (001-127) ★	Module Name/Tag # (20 character max.) ★

Baud Rate

★ ☐ 2400
☐ 4800
☐ 9600
☐ 19200
☐ 38400
☐ Other...

Communications Protocol

★ ☐ MODBUS RTU
☐ PROFIBUS
☐ ASCII
☐ Other...

Data Character Format

★ ☐ No Parity, 8 Data Bits, 1 Stop Bit
☐ Even Parity, 8 Data Bits, 1 Stop Bit
☐ Odd Parity, 8 Data Bits, 1 Stop Bit
☐ No Parity, 8 Data Bits, 2 Stop Bits
☐ Even Parity, 8 Data Bits, 2 Stop Bits
☐ Odd Parity, 8 Data Bits, 2 Stop Bits
☐ Other...

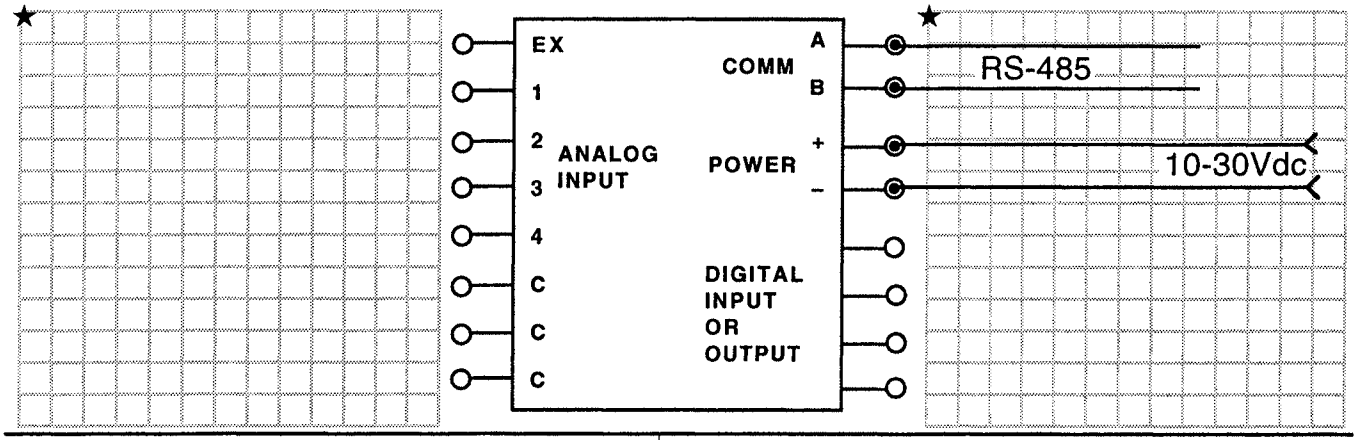
★

MOORE INDUSTRIES

MDS Module w/-MD Option Configuration Form

INFORMATION IN ★'d FIELDS CAN BE SAVED IN MODULE CONFIGURATION FILE.

Customer/User Name (24 character max) ★	Date
Job Number	Line Item Number
Module Serial Number	Completed By
Configuration File Number **236-75B05-**_____	MDSCNFG.exe Version Number



Module Communications Address (001-127) ★	Module Name/Tag # (20 character max.) ★

Baud Rate

★ ☐ 2400
☐ 4800
☐ 9600
☐ 19200
☐ 38400
☐ Other...

Communications Protocol

★ ☐ MODBUS RTU
☐ PROFIBUS
☐ ASCII
☐ Other...

Data Character Format

★ ☐ No Parity, 8 Data Bits, 1 Stop Bit
☐ Even Parity, 8 Data Bits, 1 Stop Bit
☐ Odd Parity, 8 Data Bits, 1 Stop Bit
☐ No Parity, 8 Data Bits, 2 Stop Bits
☐ Even Parity, 8 Data Bits, 2 Stop Bits
☐ Odd Parity, 8 Data Bits, 2 Stop Bits
☐ Other...

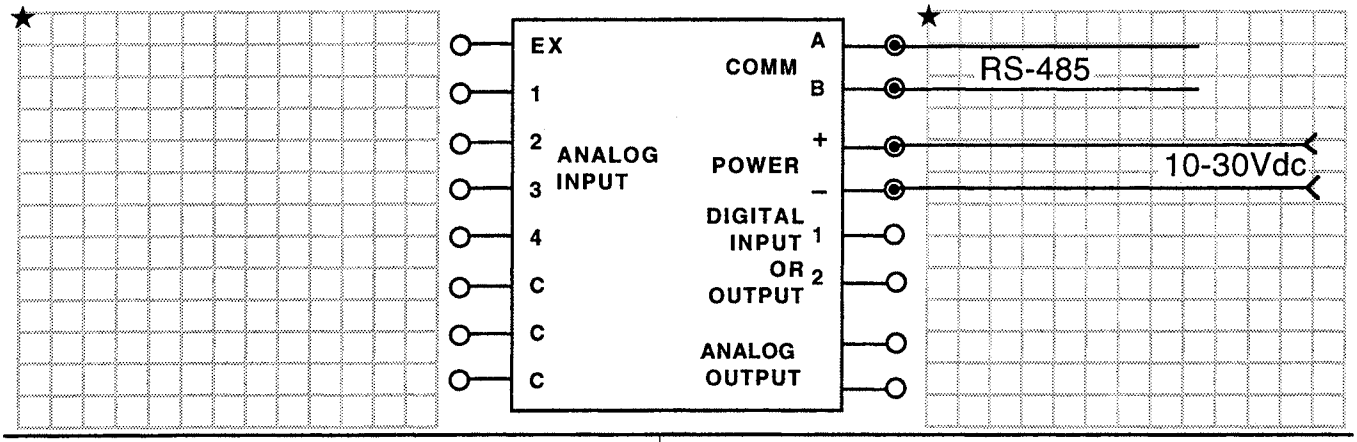
★

MOORE INDUSTRIES

MDS Module w/-MAO Option Configuration Form

INFORMATION IN ★'d FIELDS CAN BE SAVED IN MODULE CONFIGURATION FILE.

Customer/User Name (24 character max) ★	Date
Job Number	Line Item Number
Module Serial Number	Completed By
Configuration File Number **236-75B05-**_____	MDSCNFG.exe Version Number



Module Communications Address (001-127) ★	Module Name/Tag # (20 character max.) ★

Baud Rate

★ ☐ 2400
☐ 4800
☐ 9600
☐ 19200
☐ 38400
☐ Other...

Communications Protocol

★ ☐ MODBUS RTU
☐ PROFIBUS
☐ ASCII
☐ Other...

Data Character Format

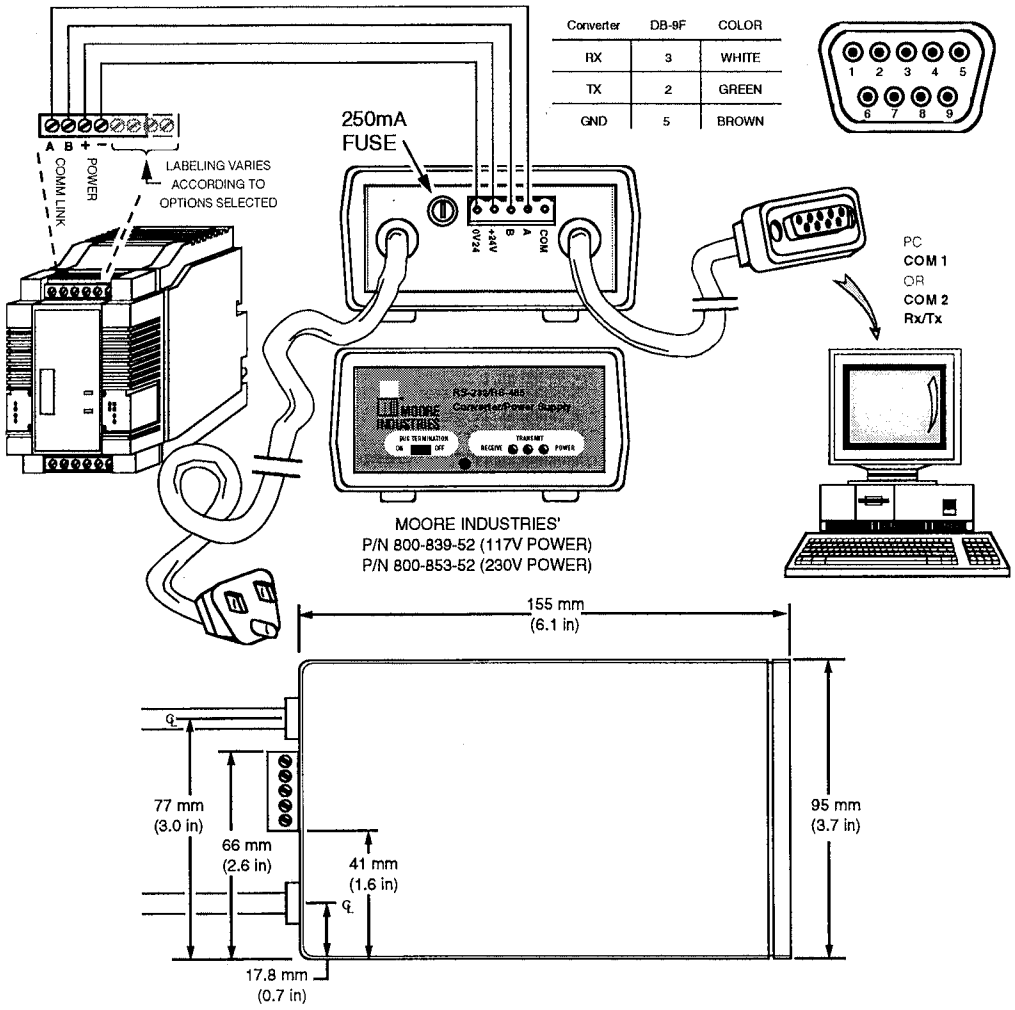
★ ☐ No Parity, 8 Data Bits, 1 Stop Bit
☐ Even Parity, 8 Data Bits, 1 Stop Bit
☐ Odd Parity, 8 Data Bits, 1 Stop Bit
☐ No Parity, 8 Data Bits, 2 Stop Bits
☐ Even Parity, 8 Data Bits, 2 Stop Bits
☐ Odd Parity, 8 Data Bits, 2 Stop Bits
☐ Other...

★

Using the Desktop Converter

Moore Industries offers two versions of the desktop RS-485-to-RS232 Converter accessory to work with the MDS. One operates on 117Vac power, the other with 230Vac power (for use outside the US).

The illustration below shows how to hookup the Converter, which integrates a 24Vdc power supply for the ***I/O EQUATION STATION***. The table following the illustration lists converter specifications.



Specifications

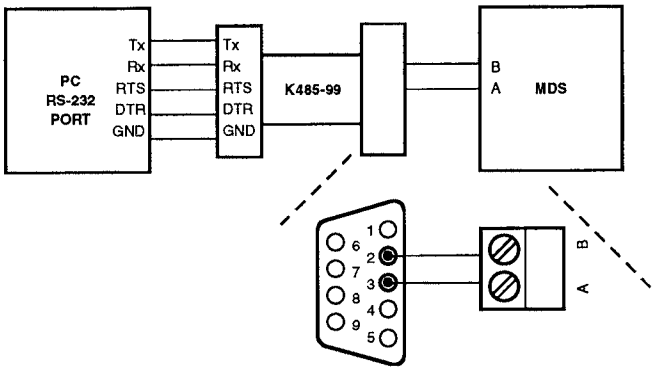
Performance	**Isolation:** 1500Vrms between RS-232 and RS-485 channels	**Power Supply**	**P/N 800-839-52:** 117Vac, ±15%, 50/60Hz **P/N 800-853-52:** 230Vac, ±15%, 50/60Hz	**Connections**	**RS-232:** Meets EIA standard for RS-232B; 9-pin D-sub miniature **RS-485:** Meets proposal 1488 and Subcommittee TR-30.1 spec
Ambient Conditions Ratings	**Operating Range:** –20°C to +60°C (–4°F to +140°F) **Storage Range:** –30°C to +85°C (–22°F to +185°F) **Relative Humidity Operating Range:** 0 to 95% non-condensing	**Output Voltage**	28Vdc; 18Vdc @ 1Amp, nominal; 17.4W	**Case**	ABS plastic and aluminum alloy, quick-connect terminal block **Weight:** 700g (approx. 1.4 lbs)

Configuring the *I/O Equation Station* (MDS) with the K485-99

Connections

The K485-99 is to be used to configure MDS modules individually only. Do not connect modules on a communications bus.

The following figure shows the necessary connections:



Software

To configure an MDS module, connect the K485-99 as shown, then:

1. **Start the MDS Configuration program, MDSCNFG.EXE.**
2. **From the Main Configuration screen, pull down the "Communication" menu.**
3. **Click/Select the "Host Parameters" menu item. The "Host Parameters" dialog box appears.**
4. **Click/Select "Internal RS-485 Port" in the "Communication" section of the dialog.**
5. **Click/Select "Ok".**

Note:
When using the MDS Configuration Software in "Measure" mode with the K485-99, your mouse may not function properly. Use your PC's TAB key to move the selection cursor from field to field, and use the UP/DOWN cursor keys to toggle selections within fields.

Declaration of Conformity

EMC Directive 89/336/EEC

Manufacturer's Name: Moore Industries-International, Inc.
Manufacturer's Address: 16650 Schoenborn Street
North Hills, CA 91343-6196
USA

Declares that the product(s):

Product Name: **MDS**

	MODEL	/	INPUT	/	OUTPUT	/	POWER	/	OPTIONS	/	HOUSING
Model Number(s):	**MDS**		*		*		**10 – 30VDC**		**-CE***		*

*Indicates any input, output, option and housing as stated in the product data sheet.

Conforms to the following EMC specifications:

EN50081-2, 1993, Generic Emissions Standard; Industrial Environment.
EN50082-2, 1995, Generic Immunity Standard; Industrial Environment.

Supplemental Information:

None.

November 25, 1998
Date

Fred Adt
Quality Assurance Director

Robert Stockham
Moore Industries-International, Inc.

European Contact: Your Local Moore Industries Sales and Service Office

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RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

   Warranty Repair –
   If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

   Non-Warranty Repair –
   If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
   a) A note listing the symptoms that indicate the unit needs repair
   b) Complete shipping information for return of the equipment after repair
   c) The name and phone number of the person to contact if questions arise at the factory

3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.

4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

MOORE INDUSTRIES™

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