Control Technology Inc.

5734 Middlebrook Pike
Knoxville, Tennessee 37921

www.controltechnology.com
Toll Free: 800-537-8393

2500 Series ™ Compact IO System

2500C-RBC-PRF

PROFIBUS REMOTE BASE CONTROLLER

2500 SERIES® COMPACT I/O

INSTALLATION AND OPERATION GUIDE

Version 1.4

DOCUMENT DISCLAIMER STATEMENT

REVISION HISTORY		
V1.0	2014	Original Issue
V1.1	5/22/2015	Corrected Revision History
V1.2	6/17/2015	Corrected Profibus Addressing Table 1
V1.21	6/30/2015	Changed Section Title. This section refers only to Workshop Configuration not COMPROFI.
V1.3	3/27/2018	Table 1 Addressing Corrected. Section 3.5 changed Figure 9 and added NOTE. Added this to section 2.8 : "The 505 Mismatch Mode is selectable under the Slave Parameters Tab as shown is Figure 18. Parameter Editing Screens" Improvements in Chapter 3 with new screen shots, notes and information.
V1.4	5/8/2018	*NOTE:* *Any empty slots to the left of a module must contain a "Blank Space" selection. Once you have configured all the modules, you do not have to configure any empty spaces to the right of the last as "Blank Space".* This was added on Page 25 in 3.6. Configure the 2500C-RBC-PRF

PREFACE

This ***Installation and Operation Guide*** provides reference information for the CTI 2500C-RBC-PRF Profibus Remote Base Controller. The information in this manual is directed to individuals who will be installing the module and configuring it for use with a Profibus Master.

We assume you are familiar with the installation and operation of:

1)   CTI 2500 Series and Simatic® 505® programmable controllers,

2)   PLC WorkShop™ for Siemens 505™ or Com Profibus Configuration Software

Please refer to the appropriate user documentation for specific information on your programmable controllers and I/O modules.

USAGE CONVENTIONS

> *NOTE:*
> *Notes alert the user to special features or procedures.*

> *CAUTION:*
> *Cautions alert the user to procedures that could damage equipment.*

> **WARNING:**
> **Warnings alert the user to procedures that could damage equipment and endanger the user.**

TABLE OF CONTENTS

Table of Figures

CHAPTER 1. DESCRIPTION

1.1. Introduction

The CTI 2500C-RBC-PRF Profibus Remote Base Controller is a member of Control Technology's compact family of I/O modules compatible with the programmable controllers.

The 2500C-RBC-PRF Profibus Remote Base Controller (RBC) allows a CTI 2500C Series base to function as a slave node on a Profibus-DP I/O channel that complies with the PROFIBUS standard (DIN 19245, Part 3). It provides the following functions:

- Compatible with CTI 2500 Series, Simatic® 505, Siemens® S5 and S7 masters
- Can be used in currently-available CTI compact 4-, 8-, and 16-slot bases
- Supports communication speeds from 9.6 Kbaud (maximum cable distance per segment: 1200 m) up to 12 Mbaud (maximum cable distance per segment: 100 m).
- Includes an LED display which shows error codes and a separate LED display which shows the current station address.
- Configurability using the CTI 2500C-RBC-PRF "gsd" file which can be downloaded from the CTI web site www.controltechnology.com

The 2500C-RBC-PRF resides in CTI 2500 Compact Series base. It installs in the second slot from the left, adjacent to the power supply module.

Figure 1. 2500C-RBC-PRF Front Panel

WARNING

⚠️ **The USB Port is for CTI internal use and connection only.**
Do not use, connect, or disconnect the USB cable unless area is known to be non-hazardous.
Connection or disconnection in an explosive atmosphere could result in an explosion.

CHAPTER 2. INSTALLATION

The installation of the Model 2500C-RBC-PRF Profibus Remote Base Controller consists of the following steps:

1)   Planning the installation,
2)   Verifying power requirements
3)   Unpacking and configuring the module,
4)   Physical installation,
5)   Connecting cables,
6)   Checking the module operation.

2.1. Installation Planning

Choosing Profibus Media

The 2500C-RBC-PRF attaches directly to the Profibus-DP RS485 cable using a DB9 connector. The Profibus organization recommends using bus cable as specified in EN 50170 part 8-2 and "Cable Type A", and should comply with the parameters below. An example cable of this type would be Belden 3079A.

Cable Specification – Profibus DP	
Impedance	135 to 165Ω / 3 to 20 MHz
Capacitance	< 30 pf / m
Resistance	< 110 Ω / km
Wire gauge	> 0.64 mm
Conductor area	> 0.34 mm2

For more information on Profibus installation guidelines, see Appendix A.

Wiring the Profibus Connector

The Profibus connector should be wired as shown in Section 2.6. For more information, refer to Appendix A.

Selecting a Profibus Address

Before proceeding, you must determine what Profibus address you will assign to the module. Profibus addresses range from 0 to 127. In CTI 2500 Series and Simatic® 505 systems, address 0 and addresses 113-127 are not valid. Therefore, any address between 2 and 112 is valid for the

RBC when installed in these systems. Note that each slave node and the master must have a unique address on the bus. The master address is normally set to 1 and the first available slave address is 2.

Selecting a Profibus Speed

Before proceeding, you must determine your Profibus operating speed. The 2500C-RBC-PRF supports Profibus speed from 9.6K bits/s to 12M bits/s. For more information on selecting Profibus speed see Section 3.5.

Selecting Slave Parameters

The 2500C-RBC-PRF supports four parameterization options. These options are set using WorkShop, or using the "parameters" tab for the remote base. For more information about these settings, see "Setting Profibus Slave Parameters" in Section 3.7.

Setting Module Hardware Options

In addition to the Profibus address, the module includes a hardware setting for selecting the state of the base discrete outputs in the event of a communications loss. The module can be configured to set all outputs off, or to leave outputs at their last values.

2.2. Power Requirements

The CTI 2500C-RBC-PRF module consumes 2.5 watts of +5 VDC power from the backplane. Before installing the RBC, verify that your mounting base power budget can accommodate the required power.

2.3. Unpacking the Module

Open the shipping carton and remove the special anti-static bag that contains the module. After discharging any static build-up, remove the module from the static bag. Do not discard the static bag. Always use this bag for protection against static damage when the module is not inserted into the I/O base.

CAUTION:
The components on the 2500C-RBC-PRF module printed circuit card can be damaged by static electricity discharge. To prevent this damage, the module is shipped in a special anti-static bag. Static control precautions should be followed when removing the module from the bag and when handling the printed circuit card during configuration.


Module Configuration Jumper and Module Address Switches

Module Front Panel

Backplane Connector

Figure 2. 2500C-RBC-PRF Board Layout

Module Address switches

Freeze Jumper (JP1)

2.4. Configuring the Module

There are four steps to configuring the module and getting it operational on a Profibus network:

1. Setting the Module Address Switches
2. Setting the output state on communication loss (Freeze Jumper – JP1)
3. Setting software parameters in WorkShop
4. Configuring the remote base in WorkShop

For detailed information on using Workshop to configure a remote base with the 2500C-RBC-PRF, refer to Chapter 3.

Setting the Module Address Switches

The bank of DIP switches on the 2500C-RBC-PRF are used to select the RBC's Profibus address.

Figure 2 indicates the location of the Module Address Switches and the Freeze Jumper. The remainder of this section describes the function of the individual switches.
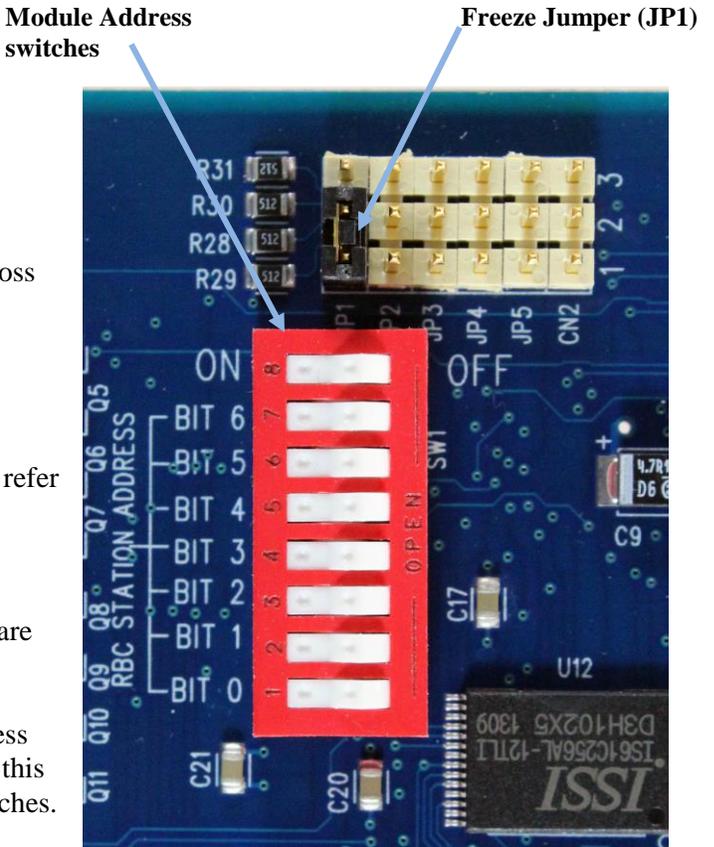
Figure 3. Switch Locations

Profibus Address Switches

Profibus Address Switches are labeled BIT 0 through BIT 6 and correspond to Switch 1 through Switch 7.
These are used to assign a station address to the RBC for identification on the Profibus-DP I/O channel. Each station in the Profibus network must be uniquely numbered. The station address is assigned as a binary number, with BIT 0 as the most significant bit (MSB) and BIT 6 as the least significant (LSB). Table 1 shows how to set the dipswitch to a station address between 0 and 125. Note that a switch in the "open" position=1 and a switch in the "closed" position=0.

SW8 – Not Used. This switch position is not used.

NOTE:
The Module Address Switches are read only at module startup. If you change the switch position after startup, you must reset the module before the setting will take effect.

Table 1. Profibus Station Address Settings

Station Address	Switch Number / State 7	6	5	4	3	2	1	Station Address	Switch Number / State 7	6	5	4	3	2	1
	Corresponding BIT Number								Corresponding BIT Number						
	6	5	4	3	2	1	0		6	5	4	3	2	1	0
0*	0	0	0	0	0	0	0	32	0	1	0	0	0	0	0
1	0	0	0	0	0	0	1	33	0	1	0	0	0	0	1
2	0	0	0	0	0	1	0	34	0	1	0	0	0	1	0
3	0	0	0	0	0	1	1	35	0	1	0	0	0	1	1
4	0	0	0	0	1	0	0	36	0	1	0	0	1	0	0
5	0	0	0	0	1	0	1	37	0	1	0	0	1	0	1
6	0	0	0	0	1	1	0	38	0	1	0	0	1	1	0
7	0	0	0	0	1	1	1	39	0	1	0	0	1	1	1
8	0	0	0	1	0	0	0	40	0	1	0	1	0	0	0
9	0	0	0	1	0	0	1	41	0	1	0	1	0	0	1
10	0	0	0	1	0	1	0	42	0	1	0	1	0	1	0
11	0	0	0	1	0	1	1	43	0	1	0	1	0	1	1
12	0	0	0	1	1	0	0	44	0	1	0	1	1	0	0
13	0	0	0	1	1	0	1	45	0	1	0	1	1	0	1
14	0	0	0	1	1	1	0	46	0	1	0	1	1	1	0
15	0	0	0	1	1	1	1	47	0	1	0	1	1	1	1
16	0	0	1	0	0	0	0	48	0	1	1	0	0	0	0
17	0	0	1	0	0	0	1	49	0	1	1	0	0	0	1
18	0	0	1	0	0	1	0	50	0	1	1	0	0	1	0
19	0	0	1	0	0	1	1	51	0	1	1	0	0	1	1
20	0	0	1	0	1	0	0	52	0	1	1	0	1	0	0
21	0	0	1	0	1	0	1	53	0	1	1	0	1	0	1
22	0	0	1	0	1	1	0	54	0	1	1	0	1	1	0
23	0	0	1	0	1	1	1	55	0	1	1	0	1	1	1
24	0	0	1	1	0	0	0	56	0	1	1	1	0	0	0
25	0	0	1	1	0	0	1	57	0	1	1	1	0	0	1
26	0	0	1	1	0	1	0	58	0	1	1	1	0	1	0
27	0	0	1	1	0	1	1	59	0	1	1	1	0	1	1
28	0	0	1	1	1	0	0	60	0	1	1	1	1	0	0
29	0	0	1	1	1	0	1	61	0	1	1	1	1	0	1
30	0	0	1	1	1	1	0	62	0	1	1	1	1	1	0
31	0	0	1	1	1	1	1	63	0	1	1	1	1	1	1

NOTE: When a Module Address Switch is in the Open Position it equals 1 and in the closed position it equals 0.

NOTE:
The address setting on the 2500C-RBC-PRF switches must match the address set for the base in WorkShop or Com Profibus for proper operation

Table 1. Profibus Station Address Settings

Station Address	Switch Number / State							Station Address	Switch Number / State						
	7	6	5	4	3	2	1		7	6	5	4	3	2	1
	Corresponding BIT Number								Corresponding BIT Number						
	6	5	4	3	2	1	0		6	5	4	3	2	1	0
64	1	0	0	0	0	0	0	96	1	1	0	0	0	0	0
65	1	0	0	0	0	0	1	97	1	1	0	0	0	0	1
66	1	0	0	0	0	1	0	98	1	1	0	0	0	1	0
67	1	0	0	0	0	1	1	99	1	1	0	0	0	1	1
68	1	0	0	0	1	0	0	100	1	1	0	0	1	0	0
69	1	0	0	0	1	0	1	101	1	1	0	0	1	0	1
70	1	0	0	0	1	1	0	102	1	1	0	0	1	1	0
71	1	0	0	0	1	1	1	103	1	1	0	0	1	1	1
72	1	0	0	1	0	0	0	104	1	1	0	1	0	0	0
73	1	0	0	1	0	0	1	105	1	1	0	1	0	0	1
74	1	0	0	1	0	1	0	106	1	1	0	1	0	1	0
75	1	0	0	1	0	1	1	107	1	1	0	1	0	1	1
76	1	0	0	1	1	0	0	108	1	1	0	1	1	0	0
77	1	0	0	1	1	0	1	109	1	1	0	1	1	0	1
78	1	0	0	1	1	1	0	110	1	1	0	1	1	1	0
79	1	0	0	1	1	1	1	111	1	1	0	1	1	1	1
80	1	0	1	0	0	0	0	112	1	1	1	0	0	0	0
81	1	0	1	0	0	0	1	113*							
82	1	0	1	0	0	1	0	114*							
83	1	0	1	0	0	1	1	115*							
84	1	0	1	0	1	0	0	116*							
85	1	0	1	0	1	0	1	117*							
86	1	0	1	0	1	1	0	118*							
87	1	0	1	0	1	1	1	119*							
88	1	0	1	1	0	0	0	120*							
89	1	0	1	1	0	0	1	121*							
90	1	0	1	1	0	1	0	122*							
91	1	0	1	1	0	1	1	123*							
92	1	0	1	1	1	0	0	124*							
93	1	0	1	1	1	0	1	125*							
94	1	0	1	1	1	1	0	126*							
95	1	0	1	1	1	1	1	127*							

NOTE: When a Module Address Switch is in the Open Position it equals 1 and in the closed position it equals 0.

NOTE:
*When connecting the 2500C-RBC-PRF, only addresses between 2 and 112 are valid. *Addresses 0 and 113-127 are not available on the CTI 2500 Series.*

The upper LED display on the front panel of the RBC shows a single digit code which indicates the module status. The lower digit led display shows the hardware Profibus address as configured by the address dip switches.
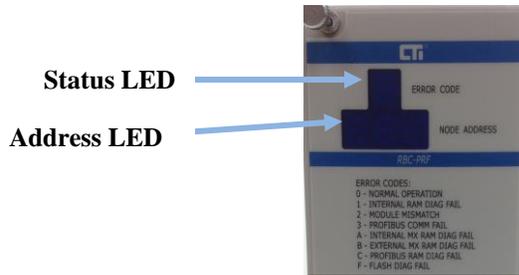
Figure 4. Status &Address LEDs

The module status codes are listed in the table below.

Display	Definition	Communications to RBC	Comment / Action
0	Normal Operation	OK	Fully Operational and Online to master.
1	Internal RAM Diagnostic Failure	None	Serious malfunction. Place system in safe state and consult CTI technical support
2	Module Mismatch	OK	I/O modules installed do not match the expected configuration in the master.
3	Profibus Communications Failure	None	There is no communication with the master. Place the system in a safe state. Check cabling and connection to the master.
A	Internal MX RAM Diagnostic Failure	None	Serious malfunction. Place system in safe state and consult CTI technical support
B	External MX RAM Diagnostic Failure	None	Serious malfunction. Place system in safe state and consult CTI technical support
C	Profibus RAM Diagnostic Failure	None	Serious malfunction. Place system in safe state and consult CTI technical support
F	Flash Diagnostic Failure	None	Serious malfunction. Place system in safe state and consult CTI technical support

Setting the Output State on Communications Loss

When I/O channel communication to a remote base is lost, the state of the discrete outputs is determined by the selection made on the 2500C-RBC-PRF jumper (JP1) - Off/Freeze.

The Freeze jumper (JP1) determines the state of outputs when I/O channel communication is lost:
    Off (Jumper position 1-2)   -   All outputs are turned off
    Freeze (Jumper position 2-3) -   All outputs hold their last value.

Figure 3. Switch Locations shows the location of jumper (JP1) on the 2500C-RBC-PRF circuit board.

NOTE:
The 2500C-RBC-PRF ships with the FREEZE jumper (JP1) in the OFF setting.

NOTE:
If the jumper JP1 is missing from the board, the 2500C-RBC-PRF defaults to the OFF setting.

For analog/word output modules, the state of the outputs is influenced not only by the position of the Off/Freeze jumper (JP1) but by the output module's (Zero/Hold Last Value) selection, if the module has that option. See the table below.

RBC Off/Freeze Selection	Analog/Word Module Zero/Hold Selection	Analog/Word Output State
Off	Zero	Zero*
Off	Hold Last Value	Last Value
Off	No selection	Last Value
Freeze	Zero	Last Value
Freeze	Hold Last Value	Last Value
Freeze	No selection	Last Value
*see the user manual of your analog/word output module for details		

Notice that the Freeze option on the RBC overrides the Zero selection on the analog/word output module; likewise, when Hold Last Value is selected on the analog/word output module, that selection overrides the "Off" option on the RBC jumper.

Setting Software Parameters in WorkShop

The 2500C-RBC-PRF has parameters that are specified using the Workshop configuration utility software. Refer to the Chapter 3 for information about using Workshop. The paragraphs below describe the parameters used to set up the 2500C-RBC-PRF.

The **Discrete I/O Interval** parameter defines the rate in milliseconds at which the 2500C-RBC-PRF updates I/O modules. This parameter specifies the minimum time between updates of the discrete I/O modules. Valid values are 1-255ms and the default value is 1ms.

The **Word I/O Update Factor** controls how often the word I/O modules are updated. The Word I/O Factor is the number of discrete I/O updates performed per word update; for example, if the factor is 2, the word I/O modules are updated on every second discrete I/O update. Valid values are 1-255 times(x) and the default value is 2x.

The **505 Mismatch Mode** parameter allows you to select the way I/O configuration mismatches are handled. With the default setting, "Disable," the 2500C-RBC-PRF handles I/O configuration mismatches according to DP Standard mode, meaning that the configuration sent by the CPU to the RBC must match the actual base configuration exactly, or else no I/O updates are performed. If you enable 505 Mismatch Mode, the RBC performs updates with all modules whose configuration matches, omitting only those modules whose configuration does not match. This mode of operation does not conform to the DP Standard. For detailed information about how mismatches are indicated and handled, see Section 2.8.

> *NOTE:*
> *If module mismatch is enabled the decimal point on the status LED will be on.*

2.5. Physical Installation

To insert the module into the I/O base, hold the top and bottom of the bezel and slide the module carefully into the slot, pushing it all the way into the base. If you have inserted the module correctly, you will feel a slight increase in resistance as the module mates with the base backplane connector. Once the module is fully seated in the slot, tighten the captive screws at the top and bottom to hold the module in place. To remove the module from the I/O base, loosen the captive screws, then move the module. Take care not to damage the connector at the back of the module when inserting or removing the module.

2.6. Connecting the Profibus Cable

The Profibus port is used to connect the 2500C-RBC-PRF to a Profibus DP network. The figure below shows the required pin outs for the DB9 Profibus port.

NOTE:
NOTE: Pins 2 and 7 are "No Connect" for the RBC. For some PROFIBUS products, these pins are used to provide 24 VDC for powering a programming or configuration tool. Such tools are not powered by the RBC; however, it is acceptable for an externally-powered PROFIBUS programming or configuration tool to drive pins 2 and 7 to 24 VDC.

Female 9-Pin D-Connector

Pin	Signal
1	CHASSIS GND
2	NO CONNECT
3*	TX/RX+
4	RTS
5	BIAS SUPPLY GND
6	BIAS SUPPLY +5V
7	NO CONNECT
8*	TX/RX-
9	BIAS SUPPLY GND

* for Pin 3: Terminal B on Siemens connector
* for Pin 8: Terminal A on Siemens connector
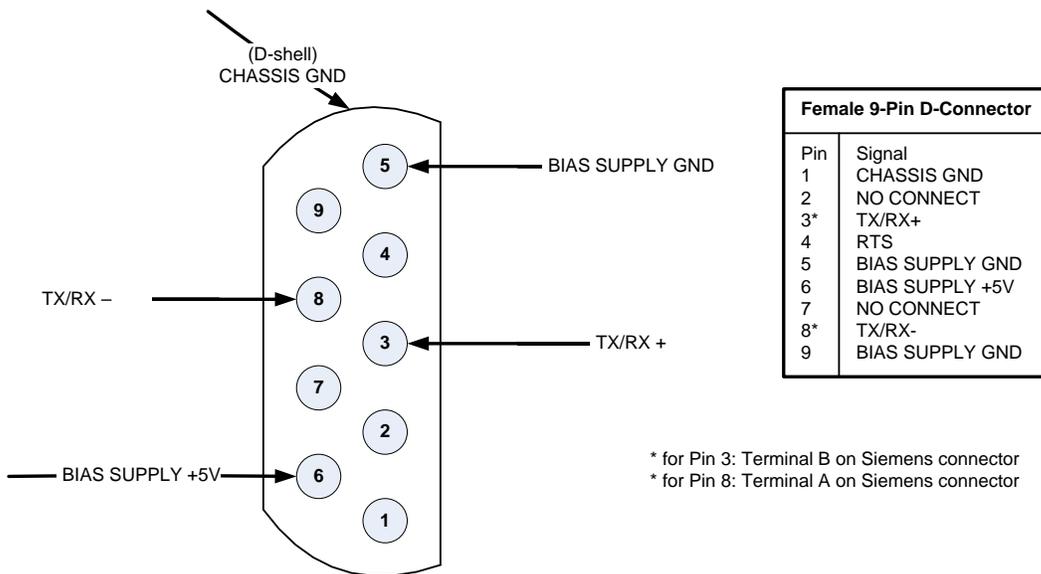
Figure 5. Profibus Female DB9 PIN Out Diagram

> *CAUTION:*
> *Pin 5 (BIAS SUPPLY +5V) and Pin 6 (BIAS SUPPLY GND) on the Profibus-DP connector are designed to support termination of the Profibus-DP cable only. These pins have a limited output power capability of approximately 0.45W. Overloading these pins by using the voltage to drive other than the normal terminating resistors can cause internal component damage to the 2500C-RBC-PRF.*

2.7. Diagnostics

The standard for PROFIBUS-DP I/O, DIN 19245, Part 3, stipulates the format that each DP slave shall use to report specific diagnostics to the DP master. The diagnostics used by the PROFIBUS-DP RBC are described below.

NOTE: Byte 1 through Byte 15, as described in this text, correspond to Octet 1 through Octet 15 in the PROFIBUS standard. For PROFIBUS-DP I/O, Bit 7 is the most significant bit (MSB), 0 is the least significant bit (LSB). This may or may not correspond to the bit numbering scheme used in your master system. For example, CTI 2500 Series and Simatic® 505/500 controllers identify the MSB of a byte as Bit 1, and the LSB of a byte as Bit 8. A DP diagnostic consists of two parts. The first part (Bytes 1 through 6) is standardized for all DP slaves. The second, or extended, part (Bytes 7 through 15 in the case of the RBC) is slave-specific. In the description that follows, it is assumed that the diagnostic has been successfully read from an RBC that has been configured and activated: that is, that Bytes 5 and 6 equal 0xBC and 0xD0, respectively.

2.8. Base Mismatch Handling in the 2500C-RBC-PRF

The 2500C-RBC-PRF automatically detects mismatches between the Profibus configuration expected by the Profibus Master and the actual remote base configuration. Depending on the type of mismatch and the configuration settings, the 2500C-RBC-PRF can operate normally or go offline and indicate a mismatch. The table below shows the response of the 2500C-RBC-PRF under various conditions. The 505 Mismatch Mode is selectable under the Slave Parameters Tab as shown is Figure 18. Parameter Editing Screens

2500C-RBC-PRF Mismatch Handling		
505 Ignore Mismatch Mode = disabled		
Action	*Display*	*Outputs*
Remove a module	2	Follow "freeze" jumper setting
Add a module to an open slot	0	Normal operation. The inserted module is ignored.
Replace a module with a different one	3/2 Flicker	Follow "freeze" jumper setting
505 Ignore Mismatch Mode = enabled		
Action	*Display*	*Outputs*
Remove a module	2	All other slots operate normally
Add a module to an open slot	0	The inserted module is ignored, all other slots operate normally
Replace a module with a different one	3/2 Flicker	The inserted module is ignored, all other slots operate normally

2.9. Mismatch Handling

When 505 Ignore Mismatch is disabled and a module is inserted into an empty slot, the 2500C-RBC-PRF ignores the inserted module and continues normal operation. The 505-6870 considers this situation a mismatch and takes the base offline.

When 505 Ignore Mismatch is disabled and the wrong module is inserted into a configured slot, the 2500C-RBC-PRF displays an "A", takes the base offline, and sets outputs based on the freeze jumper setting.

When 50X Ignore Mismatch is enabled and a module is inserted into an empty slot, the 2500C-RBC-PRF ignores the inserted module and continues normal operation.

When Profibus is stopped from the PLC, the 2500C-RBC-PRF displays a "3", sets outputs based on the freeze jumper setting, and turns inputs off.

2.10. Diagnostics

The 2500C-RBC-PRF provides diagnostic information in the PLC available in status words and through execution of the RSD instruction in the ladder logic.

PLC Status Words

NOTE: For more information on STW diagnostics, see the CTI Series 2500® CPU Programming Reference Manual, Appendix A.

STW147:
This PLC status word records the number of times, since the most recent start, that the Profibus-DP slaves have failed to respond to a request from the CPU. Each time communication is lost to the 2500C-RBC-PRF, STW147 increments by 1. When there is a base mismatch detected by the 2500C-RBC-PRF, STW147 increments continuously. As long as the Profibus problem exists STW147 will continue to count until it reaches 65535 and then it will stop. You can manually reset it to Zero in a chart.

STW03-STW09
These 7 status words give the status for Profibus-DP slaves. Each bit corresponds to a particular Profibus address, with STW03 Bit 16 being address 1 and STW09 Bit 1 being address 112. Each bit = 0 if the address is present and operating. The bit = 1 if the address is not present or failed. When the 2500C-RBC-PRF loses communication or goes offline due to a mismatch, the corresponding bit for that address is set = 1.

STW211-STW217
These 7 status words contains the "enable" status of each Profibus address. If the slave is enabled, the bit = 1. If the slave is disabled, the bit = 0.

STW231 bits 1,2, and 16 indicate the OPERATE, CLEAR, and CONFIGURED state of the Profibus-DP I/O system.

STW232-STW238 indicate the Profibus-DP slave that have signaled a diagnostic that has not been read by an RSD instruction. The slave's bit is a 1 if a diagnostic has been signaled and not yet read.

Diagnostic Bytes from the 2500C-RBC-PRF

When an RSD instruction is executed, the 2500C-RBC-PRF returns 15 bytes of information which is stored according to the settings in the RSD instruction. In each byte, bit 7 is the MSB and bit 0 is the LSB.

Byte 1: Station_Status_1
Bit 7 = RBC parameterized from another master (see description of byte 4)
Bit 6 = Parameterization error
Bit 5 = Invalid response from RBC (always set to 0)
Bit 4 = Unsupported function request from RBC
Bit 3 = Extended diagnostics (bytes 7-15) present
Bit 2 = Configuration error
Bit 1 = RBC not ready
Bit 0 = RBC did not respond

Byte 2: Station_Status_2
Bit 7 = RBC is configured but not active (RBC can only set this to 0)
Bit 6 = Reserved
Bit 5 = RBC is operating in SYNCHRONOUS mode
Bit 4 = RBC is operating in FREEZE mode
Bit 3 = Reserved
Bit 2 = Always set to 1
Bit 1 = Always set to 0
Bit 0 = RBC waiting for parameterization

Byte 3: Station_Status_3
Bit 7 = Always set to 0
Bit 6 = Reserved
Bit 5 = Reserved
Bit 4 = Reserved
Bit 3 = Reserved
Bit 2 = Reserved
Bit 1 = Reserved
Bit 0 = Reserved

Byte 4: Diag.Master_Add
Bits 7-0 contain the address of the master that has parameterized the RBC. If none of the masters has parameterized the RBC, then the RBC inserts the address 255 in this byte.

Bytes 5-6: Ident_Number
Manufacturer identifier for the RBC. The 2500C-RBC-PRF reports BCD0 for this value.

Byte 7: Ext_Diag_Data
Device-related diagnostic header; value is 0x06.

Byte 8: Ext_Diag_Data
Bit 7 = Reserved
Bit 6 = Reserved
Bit 5 = Reserved
Bit 4 = Reserved
Bit 3 = Reserved
Bit 2 = Reserved
Bit 1 = Reserved
Bit 0 = Remote port request pending

Bytes 9-10: Ext_Diag_Data
Reserved

Byte 11: Ext_Diag_Data
Bit 7 = Slot 8 is mismatched type
Bit 6 = Slot 7 is mismatched type
Bit 5 = Slot 6 is mismatched type
Bit 4 = Slot 5 is mismatched type
Bit 3 = Slot 4 is mismatched type
Bit 2 = Slot 3 is mismatched type
Bit 1 = Slot 2 is mismatched type
Bit 0 = Slot 1 is mismatched type

Byte 12: Ext_Diag_Data
Bit 7 = Slot 16 is mismatched type
Bit 6 = Slot 15 is mismatched type
Bit 5 = Slot 14 is mismatched type
Bit 4 = Slot 13 is mismatched type
Bit 3 = Slot 12 is mismatched type
Bit 2 = Slot 11 is mismatched type
Bit 1 = Slot 10 is mismatched type
Bit 0 = Slot 9 is mismatched type

Byte 13: Ext_Diag_Data
Identifier-related diagnostic header; value is 0x43.

Byte 14: Ext_Diag_Data
Bit 7 = Slot 8 contains failed module or is mismatched type
Bit 6 = Slot 7 contains failed module or is mismatched type
Bit 5 = Slot 6 contains failed module or is mismatched type

2500C-RBC-PRF Installation and Operation Guide V1.4

Bit 4 = Slot 5 contains failed module or is mismatched type
Bit 3 = Slot 4 contains failed module or is mismatched type
Bit 2 = Slot 3 contains failed module or is mismatched type
Bit 1 = Slot 2 contains failed module or is mismatched type
Bit 0 = Slot 1 contains failed module or is mismatched type

Byte 15: Ext_Diag_Data
Bit 7 = Slot 16 contains failed module or is mismatched type
Bit 6 = Slot 15 contains failed module or is mismatched type
Bit 5 = Slot 14 contains failed module or is mismatched type
Bit 4 = Slot 13 contains failed module or is mismatched type
Bit 3 = Slot 12 contains failed module or is mismatched type
Bit 2 = Slot 11 contains failed module or is mismatched type
Bit 1 = Slot 10 contains failed module or is mismatched type
Bit 0 = Slot 9 contains failed module or is mismatched type

CHAPTER 3. SETTING UP THE 2500C-RBC-PRF USING WORKSHOP

3.1. Overview

Configuration of the Profibus network can be accomplished using either PLC WorkShop™ for Siemens 505™ (version 4.32 or above).

If you're using PLC WorkShop™ for Siemens 505™, please refer to the "PLC Memory and I/O Configuration" of the WorkShop user manual for a complete discussion of Profibus network configuration.

If you're using Workshop, follow the procedure below to configure your Profibus I/O:

1. Download GSD file for the 2500C series Profibus RBC from Control Technology Website. The file name is 'CTI2500R.gsd'
2. Startup Workshop
3. Run the PLC configuration utility.
4. Add a 2500C-RBC-PRF to the system.
5. Configure the 2500C-RBC-PRF
   a. Set address
   b. Set station name
   c. Configure I/O Slots
   d. Set memory offsets for each slot

3.2. Download GSD file from the CTI Website

To begin configuration of the 2500C-RBC-PRF, download the GSD file from the Control Technology Website. www.controltechnology.com

Under the 'Products' Tab on the CTI website, find the Compact I/O product links and click on the 'Remote Base Controllers' link. Then select the 2500C-RBC-PRF Profibus Remote Base Controller product link.

Click on the 'GSD File' link under the Files and Documents header. It will be necessary to log in on the Control Technology website in order to download this GSD file. If you are not currently a registered user on the CTI website, then you must first complete a new user registration before being able to download your file.

3.3. Start Workshop

The next step is to start Workshop and open your new or existing program. You will need to be using Workshop version 4.32 or higher in order to configure the Profibus I/O.
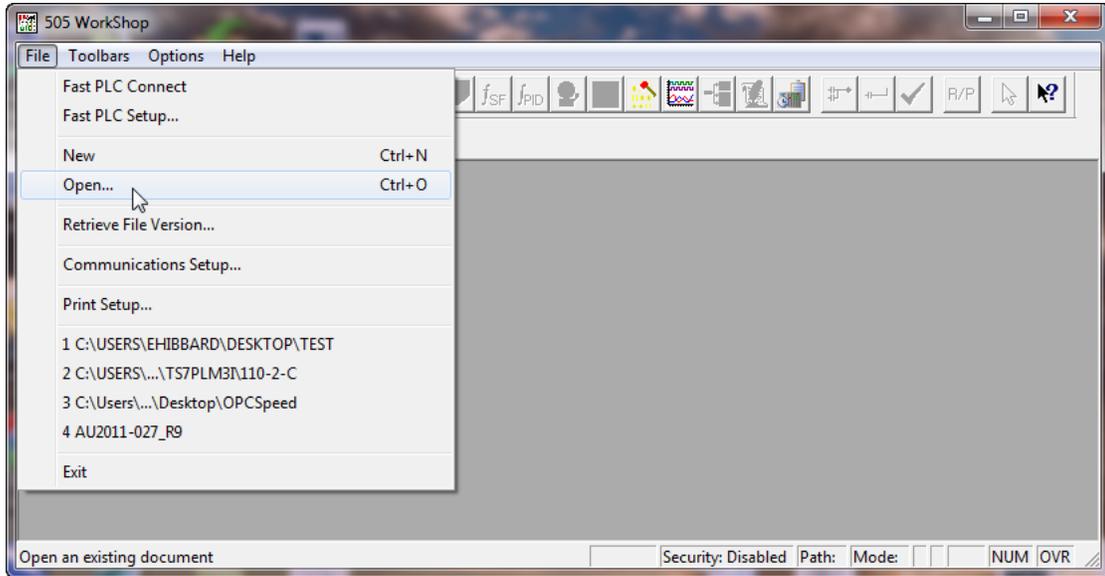
Figure 6. Workshop Startup Screen

3.4. Open the PLC Configuration

Next, open the "PLC Configuration" screen.
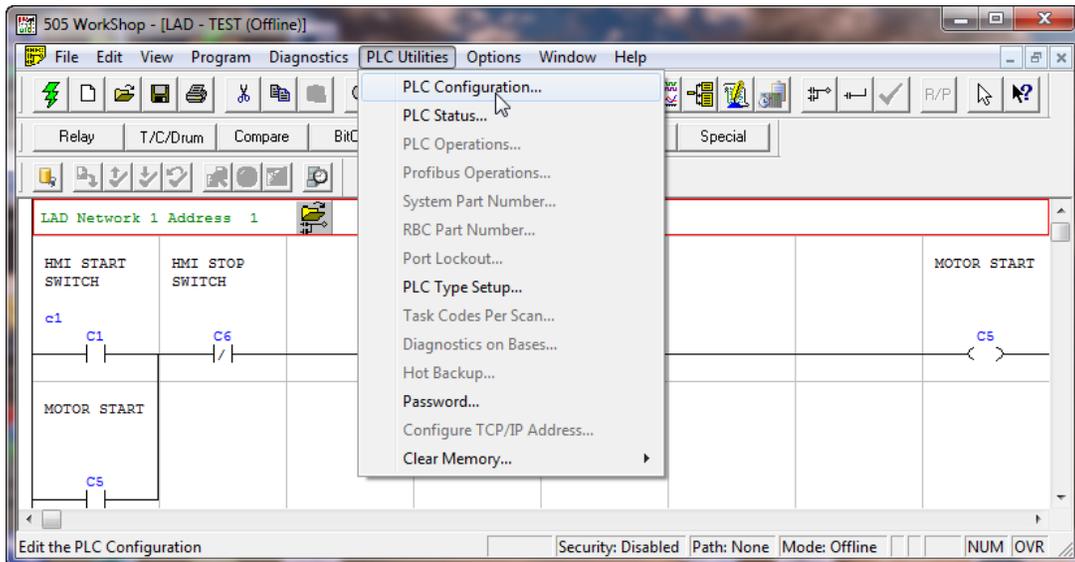
Figure 7. Workshop PLC Configuration Selection Screen

In the PLC configuration window, click on the 'Profibus I/O' button to open the Profibus configuration screen.
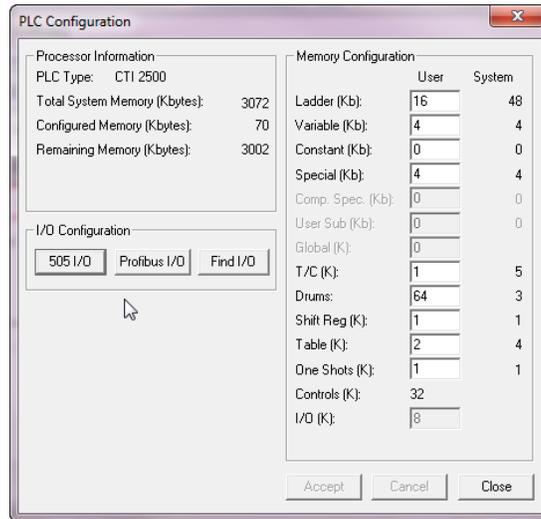
Figure 8. PLC Configuration Window

3.5. Add a 2500C-RBC-PRF to the system.

In the Profibus I/O screen, click on the 'Bus Parameters' Tab to set baud rate and other Profibus parameters.
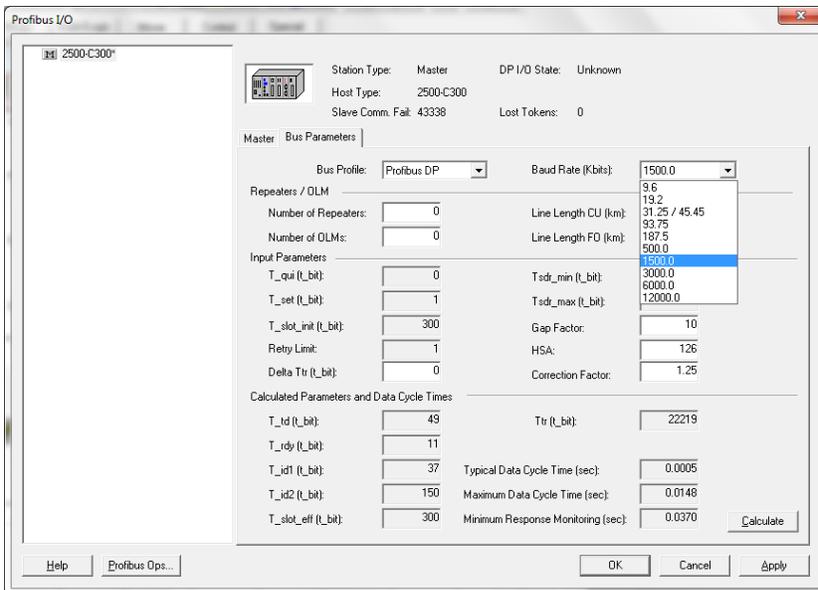
Note: It is recommended that you select the speed that calculates the Typical Data Cycle Time (sec) to be slightly less than one half of the I/O scan time. For example: If the I/O scan is 20mSecs (0.020Secs) select the Profibus speed that gives a Typical Data Cycle Time (sec) of slightly less than 10mSecs (0.010Secs).

Figure 9. Bus Parameters Screen

2500C-RBC-PRF Installation and Operation Guide V1.4

Click on the 'Master Tab'. You may enter a station name and Host name for the Profibus master. Next, you will be configuring the Profibus slave(s). Click on the 'Add Slave' button to add your profibus RBC('s).
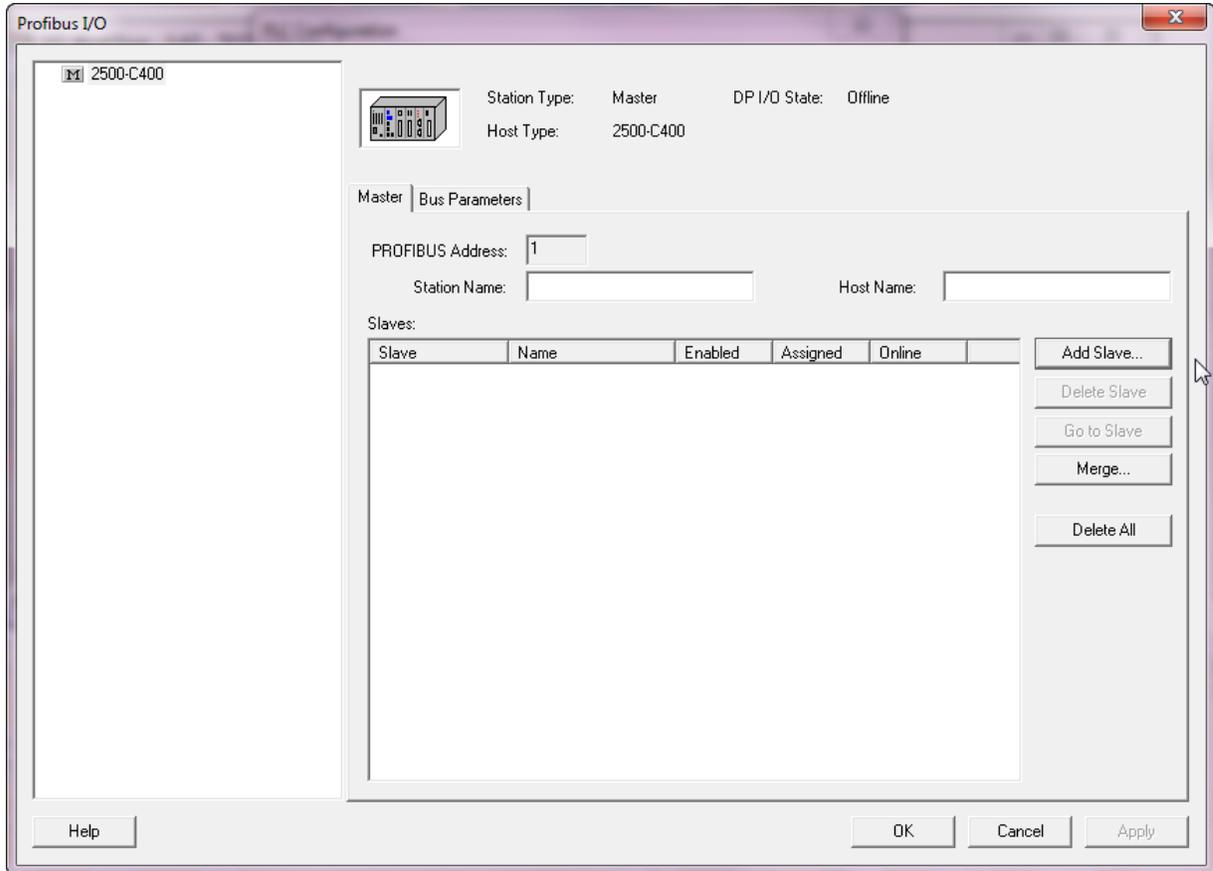
Figure 10. Profibus I/O Screen

You will now need to add the GSD file that you downloaded from the CTI website. Click on the 'Add Hardware' button.
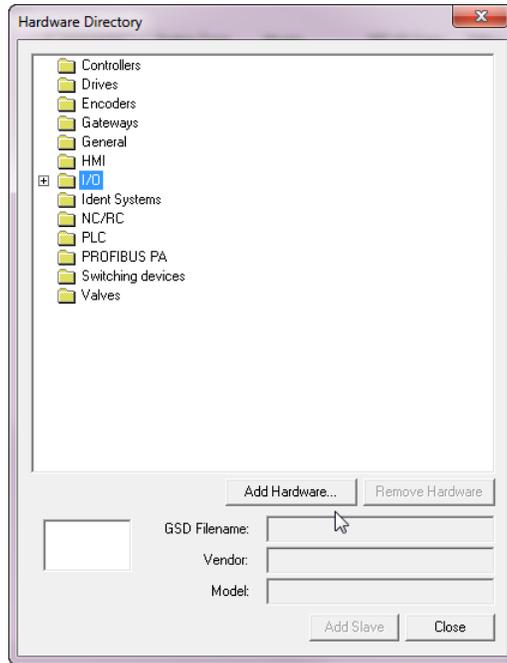
Figure 11. Hardware Directory Screen

Browse in your Windows downloads directory and open the 'CTI2500.gsd' file.
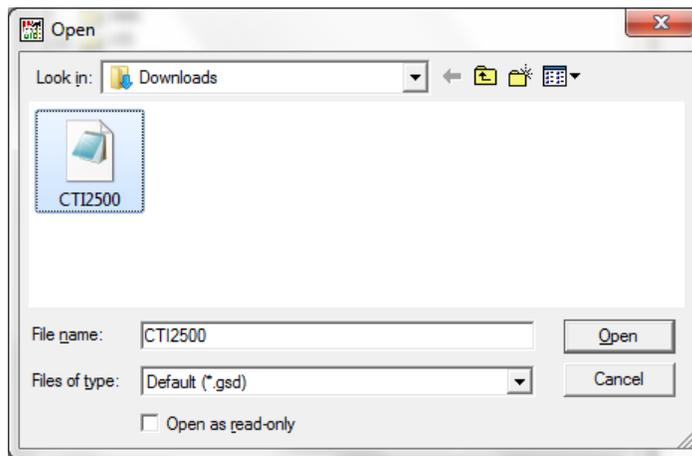
Figure 12. Windows Explorer and CTI .gsd Locator Screen

The GSD definition for your Compact RBC module will now be loaded into the hardware directory. The GSD definition for the 2500C-RBC-PRF module should be located under the 'I/O'/CTI folder. The correct filename is 'CTI2500.gsd'. Click the 'Add Slave' button after selecting the correct GSD file.
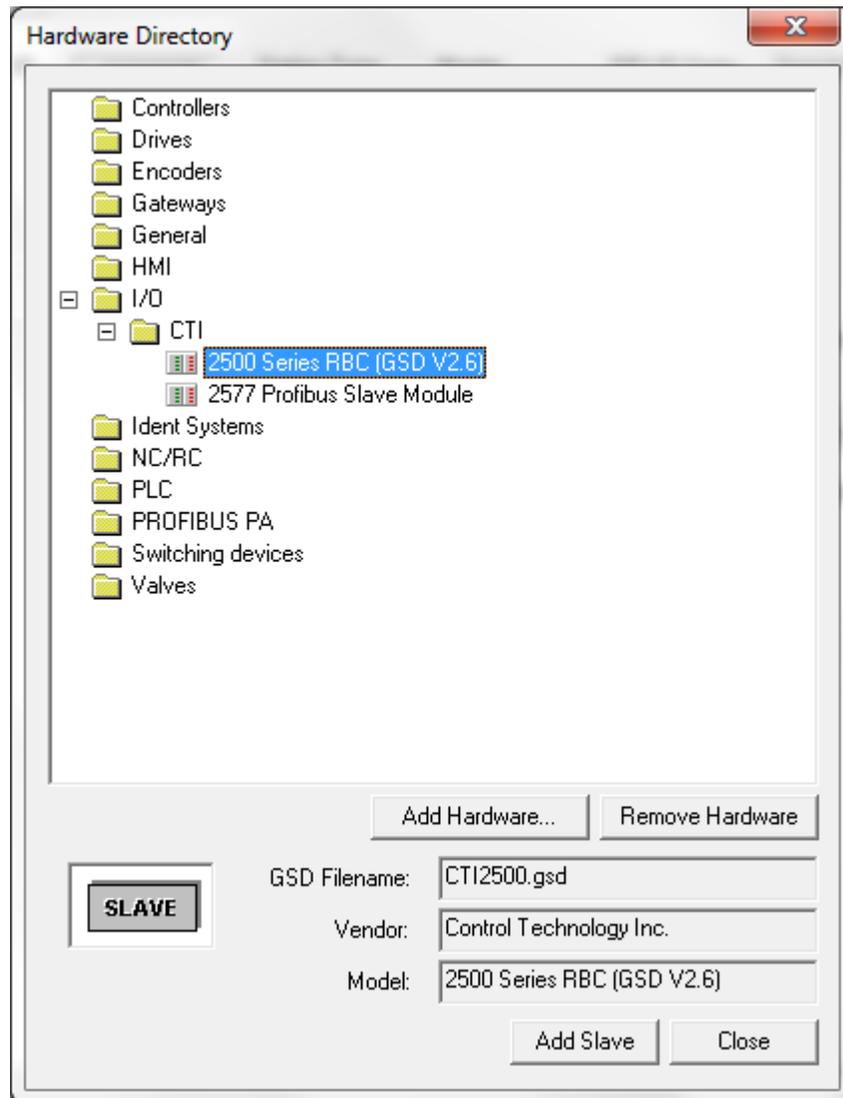
Figure 13. Add Slave Selection in Hardware Directory Screen

Each time that you click the 'Add Slave' button another RBC module will be added to your I/O configuration. After adding the desired number of RBC's, click the 'Close' button. Note in the Model Field where "(GSD V2.6)" is shown, the "2.6" is the current version of GSD file provided by CTI, your version could be different.

> Note: In the Model Field where "(GSD V2.6)" is shown, the "2.6" is the current version of GSD file provided by CTI, your version could be different.

3.6. Configure the 2500C-RBC-PRF

To configure your RBC, select the desired profibus slave node from the list of slaves and click on the 'Go to Slave' button.
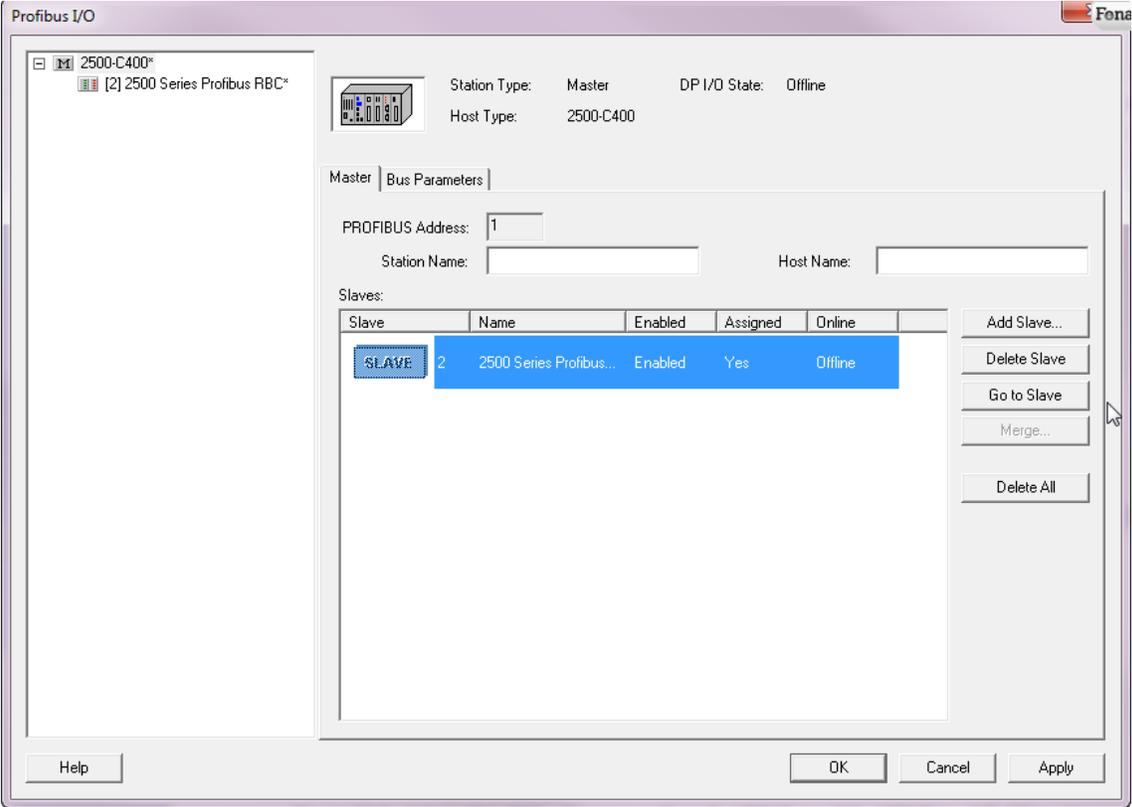
Figure 14. Go to Slave Button Screen

Enter a unique Profibus address or keep the automatically assigned one. Then enter a station name.
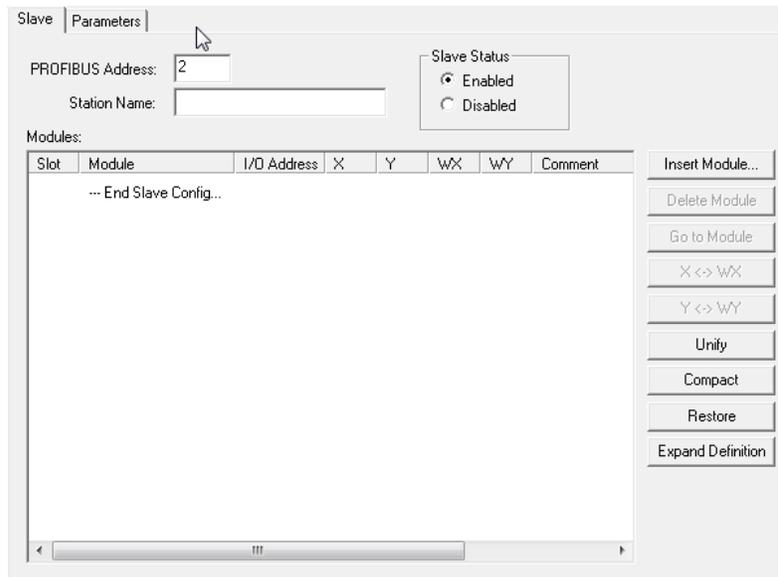
Now you will configure the I/O slots in your remote base. Click on 'Insert Module'.

Figure 15. I/O Configuration Screens

Scroll through the module list to find the 2500C series devices. Select the desired module for I/O slot #1 and then press the 'Add Module' button. Then select the module for each of the remaining slots and add them in like manner.

NOTE:
Any empty slots to the left of a module must contain a "Blank Space" selection. Once you have configured all the modules, you do not have to configure any empty spaces to the right of the last as "Blank Space".
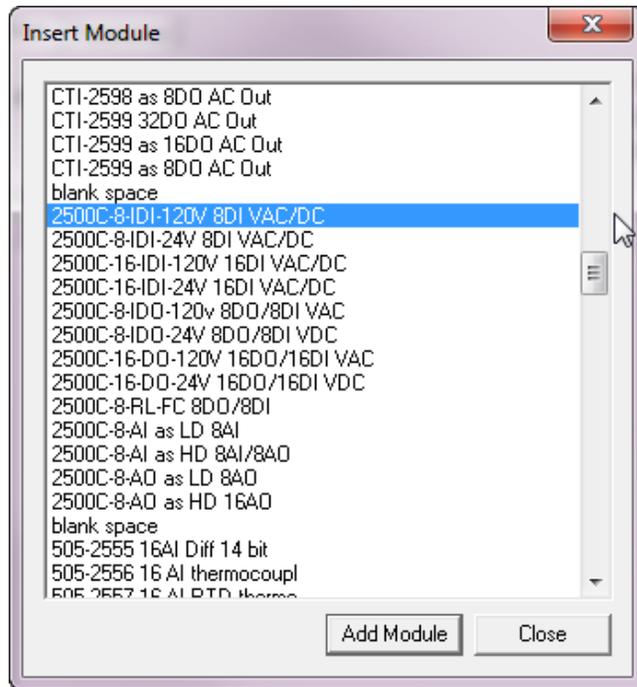

Figure 16. Module Selection Screen

Each module in the remote base needs a unique starting I/O address. You can enter the starting I/O address of a module by clicking on the address field on the module row.

Figure 17. Module Addressing Screen

Modules that use X and Y memory must have unique addresses because X and Y variables share the same memory table on the CPU. An 'X32' and a 'Y32' cannot coexist in the same program. Likewise, modules that use WX and WY memory must have unique memory addresses assigned. However, because WX/WY memory is separate from X/Y memory, it is completely acceptable to have both a X32 and a WX32 in the same program.

NOTE:
The local base is defined as the rack that contains the CPU. Be careful that you do not overlap memory addresses with modules in your local base or other remote bases.

Example: If the local base rack uses addresses 1-32 of X/Y memory, the 8pt digital input card in slot #1 of the first remote base must have a starting address of a least '33' and will use memory addresses 33through 40. The next 8pt digital card will need a starting address of 41.

3.7. Setting Profibus Slave Parameters

The following Profibus parameters can be set for each Profibus slave : *Discrete I/O Update Interval*, *Word I/O Update Factor*, and *505 Mismatch Mode*. These parameters are defined in section 2.4.

Click on the "Parameters" tab for the remote base.
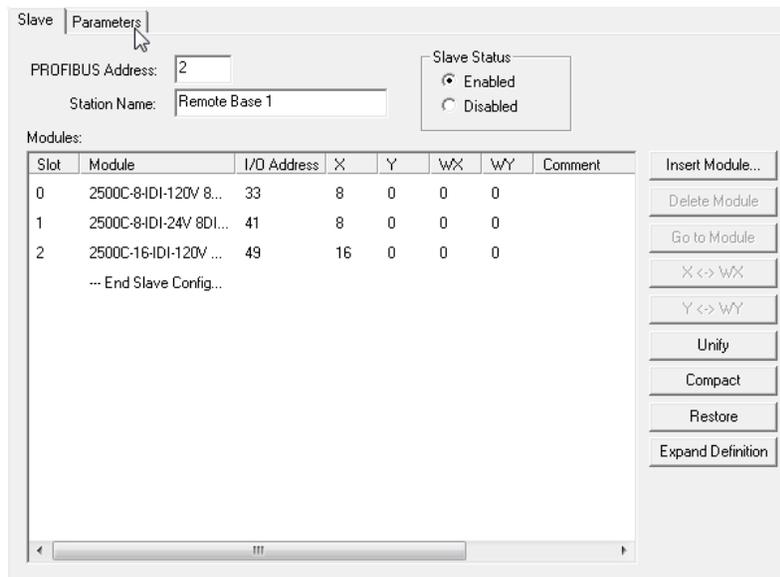
If you desire to change any of the parameters, click on the 'Value' field and type a new value.

Figure 18. Parameter Editing Screens

After configuring each of your Profibus slaves, you may click 'OK' and then 'Close' to exit the Profibus and PLC configuration screens. The Profibus RBC's will be initialized when you download the program to the system CPU.

APPENDIX A. PROFIBUS INSTALLATION GUIDELINES

These Profibus Installation Guidelines are based on the PNO *Profibus Guideline*, September 1998.

General Installation Information

Maximum number of stations

Maximum number of stations participating in the exchange of user data	DP: 126 (addresses from 0 .. 125) FMS: 127 (addresses from 0 .. 126)
Maximum number of stations per segment including repeaters	32
Available data transfer rates in kbit/s	9.6, 19.2, 45.45, 93.75, 187.5, 500, 1500, 3000, 6000, 12000
Max. number of segments in series	According to EN 50170, a maximum of 4 repeaters are allowed between any two stations. Dependent on the repeater type and manufacturer, more than 4 repeaters are allowed in some cases. Refer to the manufacturer's technical specification for details.

Cable Type

The bus cable is specified in EN 50170 part 8-2 as "Cable Type A", and should comply with the parameters in the following table. Cable Type B, which is also described in EN 50170, is outdated and should no longer be used.

Parameter	Cable type A
Characteristic impedance	35 ... 165 ohms at a frequency of (3-20 MHz)
Operating capacity (pF/m)	< 30
Loop resistance (W/km)	< =110
Core diameter (mm)	> 0.64 *)
Core cross-section (mm²)	> 0.34 *)

Cable Lengths

Data transfer rate in kbit/s	9.6	19.2	45.45	93.75	187.5	500	1500	3000	6000	12,000
Max segment length in meters	1200	1200	1200	1200	1000	400	200	100	100	100

Important: In a PROFIBUS-DP/FMS installation, you must choose a data transfer rate which is supported by all devices connected to the bus. The chosen data transfer rate then determines the maximum segment lengths as shown above.

The maximum admissible distance between two bus stations in each PROFIBUS network can be calculated as follows:
*(NO_REP + 1) * Segment length*

NO_REP= The maximum number of repeaters connected in series (depends on repeater type).

Bus termination

In order to minimize cable reflections and ensure a defined noise level on the data lines, the data transfer cable must be terminated at both ends with a terminating resistor combination as follows.
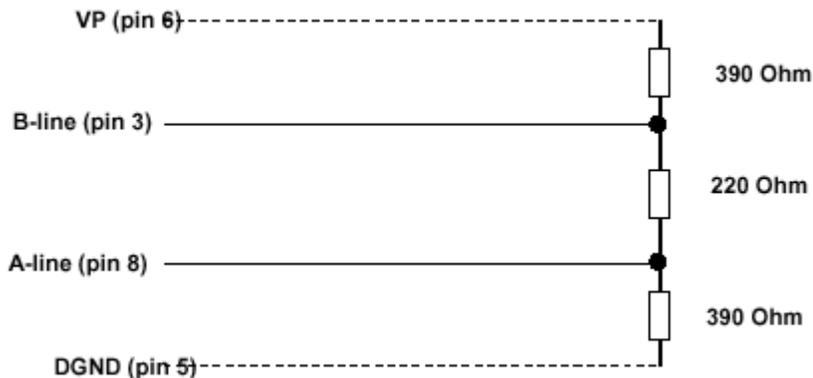
Bus connectors and PROFIBUS-DP/FMS interface

A bus connector is used to connect the bus cable to the PROFIBUS device. Bus connectors are available with a variety of protection classes and mechanical designs. The choice of connector is mainly determined by the space available in the vicinity of the PROFIBUS device (i.e. PC interface, PLC or special fieldbus device). EN 50170 Volume 2 recommends the use of a 9-pin Sub-D connector. Depending on the required protection class and the application of the fieldbus device, other connector designs are also allowed. The table below shows the pin assignment if a 9-pin Sub-D connector is used:

| Pin no.	Signal	Significance
1	Shield	Shield/functional ground
2	M24	Ground for +24 V output voltage
3	**RxD/TxD-P *)**	**Receive/Transmit data – plus (B wire)**
4	CNTR-P	Repeater control signal (direction control), RTS signal
5	**DGND *)**	**Data ground (reference potential for VP)**
6	**VP *)**	**Supply voltage - plus (P5V)**
7	P24	Output voltage +24 V
8	**RxD/TxD-N *)**	**Receive/Transmit data – minus (A wire)**
9	CNTR-N	Repeater control signal (direction control)

Make sure that the connector type used is suitable for the selected baud rate.

To prevent EMC interference from entering the device, the cable shield should be connected to the functional ground of the device (generally the electrically conductive case). This is done by connecting the cable shield to the metal case of the Sub-D connector and the functional ground over a large area. The bus connector must have a low-impedance connection to the cable shield. The data transfer technology of the serial bus system, which uses a shielded twisted pair data cable, is described in the specification of the interference-immune RS 485 interface standard. To allow correct bus termination, each station must connect the signals DGND and VP (5 V) to pins 5 and 6 of the connector, respectively. The 5 V supply for the terminating resistors (VP) should have a minimum current rating of 10 mA (the current load can increase to 12 mA if a NULL signal is sent through the bus). The current rating should be increased to app. 90 mA if you need to be able to supply other types of devices on the bus such as bus terminals and optical fiber cable drivers.

Due to the capacitive load of the station and the resulting cable reflections, bus connectors should be provided with built-in series inductors as shown below. Due to the built-in series inductors in the bus connectors, all bus connectors in the network should be attached to fieldbus devices to ensure that the necessary capacitive load is provided by the device input capacitance.
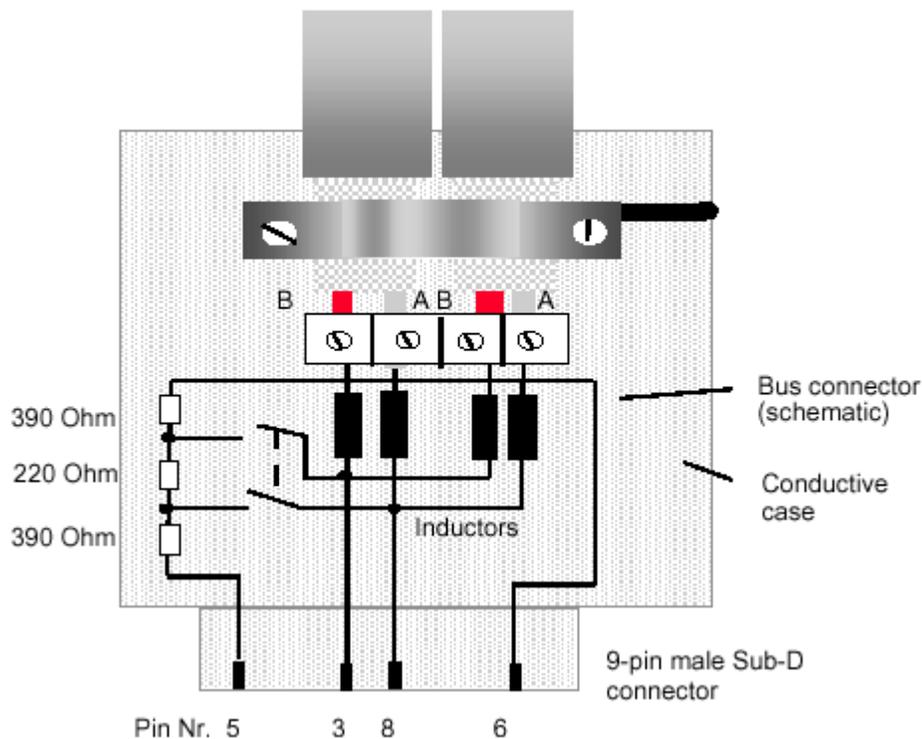
Cable laying guidelines

Laying of copper cable

Data transfer in PROFIBUS systems is based on an interference-immune symmetrical bus system to the RS 485 specification using shielded twisted pair cable. With correct system installation, small external sources of interference are led to ground through the cable shield without causing interference in the data lines. Interference of this type can largely be avoided with appropriate EMC measures such as EMC-compliant system installation, EMC-compliant cable laying and measures that avoid large ground potential differences.

Electromagnetic interference from sources such as switching processes, rectifiers and circuit breakers can cause equipment faults to occur. In addition, overvoltage and lightning strikes can destroy electronic components in fieldbus devices. Correct operation of the plant can then no longer be guaranteed.

Particularly for equipment containing frequency inverters (variable speed drives), the manufacturer's regulations for EMC compliance must be observed for the following components:

Filters, Chokes, and Shielding.

In addition, electronic starters should be used if fluorescent lamps are installed within control cabinets.

The following cable laying instructions apply to shielded twisted pair cables. The cable shield is used to improve the immunity to electromagnetic interference. PROFIBUS cables should be shielded with a combination of both conductive braid and conductive foil. In the following, "shield" refers to both types of shields (braid **and** foil). A foil shield should not be used on its own, because it is very thin and can easily be damaged. The cable shield must be connected to the functional ground at both ends of the cable by making a large-area connection to a grounded conductive surface. When laying the bus cables, particular care should be taken to ensure that the cable shield (braid shield and foil shield, if available) is connected to the shield grounding clamp over a large area. The two PROFIBUS data lines are designated A and B. There are no regulations on which cable core color should be connected to which of the two data terminals on each fieldbus device; the sole requirement is to ensure that the same core color is connected to the same terminal (A or B) for all stations throughout the entire system **(across all stations and bus segments).** If the data transfer cable has data wires with red and green insulation, then the following assignment should be used:

Data cable wire A - green
Data cable wire B – red

This rule applies to both the incoming and the outgoing data lines.

Laying cables within control cabinets

If a repeater or fieldbus device is installed within a control cabinet, the cable shield of the incoming bus cable should be electrically connected to a grounding rail as close as possible to the cable leadthrough using a shield grounding clamp or similar (see Figure 3-1). The cable shield should continue within the cabinet to the fieldbus device and be connected there in accordance with the manufacturer's instructions. The following installation guidelines should be observed. Ensure that the case of the device and also the control cabinet in which the fieldbus device is mounted have the same ground potential by providing a large-area metallic contact to ground (use e.g. galvanized steel to ensure a good connection). Grounding rails should not be attached to painted surfaces. If the above measures are observed, electromagnetic interference is diverted through the cable's shield.

screen grounding clamp

grounding rail close to cable lead-through

functional ground

cable screen
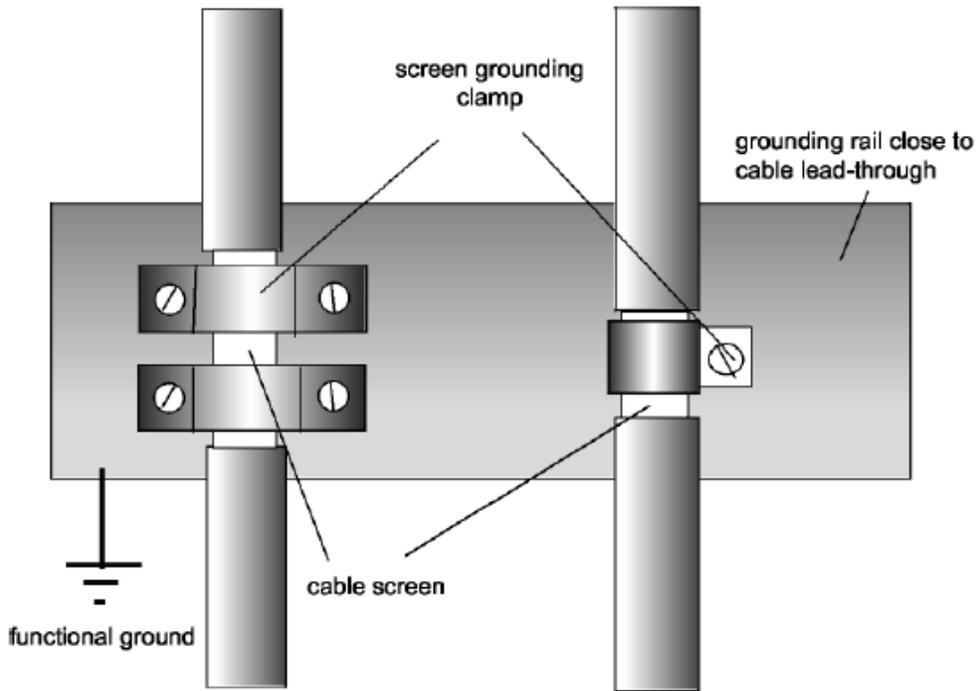
PROFIBUS cables ...

and cables for ...	must be laid ...
• Bus signals, e.g. PROFIBUS • Data signals for PC´s, programming devices, printers etc. • Screened analog inputs • Unscreened DC voltages (<= 60V) • Screened process signals (<= 25 V) • Unscreened AC voltages (<= 25V) • Coaxial cables for monitors	in the same cable loom or cable duct.
• DC voltages from 60 V ... 400 V (unscreened) • AC voltages from 25V ... 400 V (unscreened)	in separate cable looms or cable ducts without minimum spacing requirements
• DC and AC voltages > 400 V (unscreened) • Telephone cables • For areas with explosion hazard	in separate cable looms or cable ducts without minimum spacing requirements

Laying cables outside of control cabinets

All cable ducts should be constructed of electrically conducting material and connected to functional ground at regular intervals. Bus cables should not be subject to mechanical loads which exceed the manufacturer's specifications. If this cannot be avoided, additional protective measures should be taken, e.g. by laying the cables in a steel pipe or rugged metal duct. The pipe or duct should then be grounded at regular intervals and protected against corrosion.

SPECIFICATIONS

General

Module Size: Triple-Wide CTI 2500 Compact Series

Backplane Power Consumption: 2.5 watts

Compatibility: CTI 2500 Series, Simatic® 505, Siemens® S5 and S7 masters

LED Displays: Top display shows errors codes and bottom display shows the Profibus address

Output State Selection: Determines state of outputs when I/O channel communication is lost:
  off   all outputs are turned off
  freeze   all outputs hold their last value

Dipswitch Options:
  RBC station address

Software-Set Parameters:
  Discrete I/O interval
  Word I/O update factor
  Ignore mismatch mode
  RS232 port enable/disable (Not Used)

Diagnostic Data:
  Station status (3 bytes)
  Master address (1 byte)
  Ident number (1 byte)
  Extended diagnostics (9 bytes)

Ports

Profibus: 9-pin female, pins 2,7 "no connect"

Communication Speeds Supported: 9600, 19.2K, 93.75K, 187.5K, 1.5M, 3.0M, 6.0M, 12M

Profibus Port Isolation: 1500VDC

Environmental

Operating Temperature: 0º to 60º C (32º to 185º F)

Storage Temperature: -40º to 85º C (-40º to 185º F)

Humidity: 5% to 95%, non-condensing

Agency Approvals Pending: UL, ULC, CE

Shipping Weight: 1.5 lb. (0.68 Kg)

LIMITED PRODUCT WARRANTY

CTI warrants that this CTI Industrial Product shall be free from defects in material and workmanship for a period of one (1) year after purchase from CTI or from an authorized CTI Industrial Distributor. This CTI Industrial Product will be newly manufactured from new and/or serviceable used parts which are equal to new in the Product.

Should this CTI Industrial Product fail to be free from defects in material and workmanship at any time during this (1) year warranty period, CTI will repair or replace (at its option) parts or Products found to be defective and shipped prepaid by the customer to a designated CTI service location along with proof of purchase date and associated serial number. Repair parts and replacement Product furnished under this warranty will be on an exchange basis and will be either reconditioned or new. All exchanged parts or Products become the property of CTI. Should any Product or part returned to CTI hereunder be found by CTI to be without defect, CTI will return such Product or part to the customer.

This warranty does not include repair of damage to a part or Product resulting from: failure to provide a suitable environment as specified in applicable Product specifications, or damage caused by an accident, disaster, acts of God, neglect, abuse, misuse, transportation, alterations, attachments, accessories, supplies, non-CTI parts, non-CTI repairs or activities, or to any damage whose proximate cause was utilities or utility like services, or faulty installation or maintenance done by someone other than CTI.

Control Technology Inc. reserves the right to make changes to the Product in order to improve reliability, function, or design in the pursuit of providing the best possible Product. CTI assumes no responsibility for indirect or consequential damages resulting from the use or application of this equipment.

THE WARRANTY SET FORTH ABOVE IN THIS ARTICLE IS THE ONLY WARRANTY CTI GRANTS AND IT IS IN LIEU OF ANY OTHER IMPLIED OR EXPRESSED GUARANTY OR WARRANTY ON CTI PRODUCTS, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE AND IS IN LIEU OF ALL OBLIGATIONS OR LIABILITY OF CTI FOR DAMAGES IN CONNECTION WITH LOSS, DELIVERY, USE OR PERFORMANCE OF CTI PRODUCTS OR INTERRUPTION OF BUSINESS, LOSS OF USE, REVENUE OR PROFIT. IN NO EVENT WILL CTI BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR CONSUMER PRODUCTS, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY FROM STATE TO STATE.

REPAIR POLICY

In the event that the Product should fail during or after the warranty period, a Return Material Authorization (RMA) number can be requested orally or in writing from CTI main offices. Whether this equipment is in or out of warranty, a Purchase Order number provided to CTI when requesting the RMA number will aid in expediting the repair process. The RMA number that is issued and your Purchase Order number should be referenced on the returning equipment's shipping documentation. Additionally, if the product is under warranty, proof of purchase date and serial number must accompany the returned equipment. The current repair and/or exchange rates can be obtained by contacting CTI's main office at 1-800-537-8398.

When returning any module to CTI, follow proper static control precautions. Keep the module away from polyethylene products, polystyrene products and all other static producing materials. Packing the module in its original conductive bag is the preferred way to control static problems during shipment. Failure to observe static control precautions may void the warranty. For additional information on static control precautions, contact CTI at 1-800-537-8398.