CDI 310

Installation & Start-up Manual

CDI 310 Modbus Plus™ Gateway For CDI 300 Network

CDI310-04
EFFECTIVE 9/23/93

ABB Drives

ABB

CDI 310 Modbus Plus Gateway
For CDI 300 Network

Installation & Start-up Manual

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General Safety Instructions

Warnings in this manual appear in either of two ways:

- *Dangerous voltage warnings*, preceded by a Dangerous Voltage symbol, indicate the presence of voltages which may cause death or serious injury. These warnings describe procedures to avoid death or serious injury.

- *General warnings*, preceded by a General Warning symbol, indicate situations or conditions which may cause death or serious injury. These warnings describe procedures to avoid death or serious injury.

CAUTIONS inform you of situations or conditions which will damage machinery or cause additional motor-operation down-time if you do not take suggested steps to correct or address such situations or conditions.

Note: Notes provide you with additional and useful information. Although less urgent than cautions and warnings, notes are important and should not be ignored.

Warning Symbols

For your own safety please pay special attention to instructions containing these symbols:

This warning symbol indicates the presence of dangerous voltage. This symbol informs you of high voltage conditions, situations, and locations that may cause death or serious injury if you do not follow precautions and proper steps.

This warning symbol indicates a general warning.

This warning symbol indicates an electrostatic discharge hazard.

Warnings, Cautions, and Notes

WARNING! Your drive contains dangerous voltages when connected to the line power. Always check that the ACS 501 is safe, after disconnecting the power, by measuring the DC bus voltage and line input voltage. Failure to check voltages could cause death or serious injury. Only a qualified electrician should carry out the electrical installation.

Note that the Motor Control Card of the ACS 501 is at DC bus voltage potential.

The DC bus capacitors contain dangerous DC voltage levels ($1.35 \times V_{IN}$). After disconnecting the supply, wait at least five minutes after the display readout on the control panel has disappeared before taking any measurements.

Dangerous external control voltages may be present on the relay outputs of the Control Interface Card and Option Cards.

CAUTION: Electrostatic Discharge (ESD) can damage electronic circuits. Do not handle any components without following the proper ESD precautions.

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Chapter 1 – Introduction

This chapter describes the purpose and contents of this manual, describes the intended audience, explains conventions used in this manual, and lists related publications.

Overview

This document is a users guide for the ABB Drives CDI 310 Modbus Plus Gateway. This stand-alone device provides the necessary hardware and software to transfer data between the CDI 300 network and the Modicon Modbus Plus network.

This manual has the following chapers.

Chapter 1 - Introduction, the chapter you are reading now, introduces you to the CDI 310 Modbus Plus gateway, and conventions used throughout the manual.

Chapter 2 - Hardware Description provides an overview of the CDI 310 hardware, including the communication and power connections.

Chapeter 3 - Hardware Installation describes the hardware installation for the unit.

Chapter 4 - Software Installation describes the software installation for the unit. This chapter especially describes in details the configuration for the unit.

Chapter 5 - Modbus Plus Programming describes the Modbus Plus access to the gateway, and the compatibility for the Modbus Plus network.

Appendix A - Example gives one configuration example for the use of the gateway.

Intended Audience

The audience for this manual has:

- Knowledge of the Modbus Plus network communication.

- Minimal knowledge of ABB product names and terminology.

- Previous experience in installing, operating, programming, or servicing the ACS/ACH 500 drives.

Modbus Plus Network

The Modicon Modbus plus network is a peer-to-peer network designed to provide data exchange between Modicon 984 industrial controllers. This network provides both message-based data exchange and high speed global data broadcast to all nodes.

Modbus Plus has provisions for bridges between different Modbus Plus networks to permit a hierarchial network design. A message may pass through up to 4 of these bridges before reaching it's destination. Global data may not pass through bridges and is only available to nodes on the same physical network segment as the source node.

The network protocol has predefined commands that permit one node to read and write the memory space of another node. All memory addressing in these commands conforms to the Modicon 984 controller's memory layout.

Modbus Plus Compatibility

The CDI 310 appears to be a 984-type controller to other devices on the Modbus Plus network. All interface to the CDI 300 network is performed using standard Modbus Plus commands that read and write the 984 4XXXX address space. The Modbus Plus node statistics are also available. No other Modbus Plus commands are supported.

When sending messages to normal 984 nodes, the Modbus Plus message address consists of up to 4 bridge node numbers followed by the target node number. If fewer than 4 bridge nodes are used, the remaining address locations are set to 0.

When sending messages to the CDI 310, the message address consists of up to 3 bridge node numbers followed by the target node number and a path number (1 to 8). If fewer than 3 bridge nodes are used, the remaining address locations are set to 0.

The path number is unique to the CDI 310 and the Modicon SA85 card. Only one command may be in process on each path at one time. By careful use of path numbers, data throughput may be maximized.

CDI 300 Network

The CDI 300 network is a peer-to-peer network designed to provide data exchange between ABB Drives products.

This network provides both message-based data exchange and high speed global data (data sets) broadcast to all stations.

CDI 300 Compatibility

The CDI 310 is a standard CDI 300 station. Data set access is fully supported and the CDI 310 may act as the bus administrator (when configured as station 0). A subset of the CDI 300 commands are supported:

- Identify host

- Set node name

- Upload/Download/Backup

- Return outgoing data set configuration

High Speed Status Data Transfer

Up to 32 words of high speed status data may be output to the Modbus Plus network (MBP) as global data. This data may be taken from any data set(s) received from the CDI 300 network.

A configuration table defines the source CDI 300 data set and word for each of 32 words in the global data output by the CDI 310 onto the MBP network.

These 32 words of global data are transmitted on the MBP every token rotation and are available to all nodes on the local MBP network.

Global Data cannot pass through most MBP bridge nodes, only the nodes on the local MBP network will receive the data.

High Speed Control Data Transfer

Up to 32 words of high speed control data transfer may be read from the Modbus Plus network global data. This data may be mapped into any data set(s) output to the CDI 300 network.

A configuration table defines a global data word (source node and word offset) from the MBP network to be mapped into a specific outgoing data set word (data set number and word offset). This table allows for 32 entries permitting multiple outgoing data sets to be utilized.

These data sets are updated constantly and are available to all nodes on the CDI 300 network.

Global Data cannot pass through most MBP bridge nodes, the global data must originate in a node on the local MBP network.

Low Priority Data Set Access

All data sets (incoming and outgoing) may be accessed using the read and write holding registers functions of the MBP network. All data sets are maintained up-to-date in a virtual 984 memory image. The layout of this image is described later.

Incoming Data Set Access

Incoming data sets may be read by accessing the appropriate virtual 984 address. The size of incoming data sets may be read from the appropriate data set size word. Care should be taken to avoid writing to the address space for incoming data sets as the data will be overwritten and invalid until updated from the CDI 300 network.

Outgoing Data Set Access

Outgoing data sets may be read and written. The size of outgoing data sets may be read from the appropriate data set size word. Care should be taken to avoid writing to the incorrect address space as the data will be overwritten.

Chapter 2 – Hardware Description

This chapter describes the hardware of the Modbus Plus gateway device. This chapter lists in detail all the communication ports on the device, as well as the front panel LED lights.

Specifications

The following specifications apply to the different ports on the device, as well as to the mechanical and environmental specifications for the gateway.

Modbus Plus Port

Interface ....Standard Modbus Plus Port

CDI 300 Port

Interface .... RS-485 multidrop

Baud Rate 9600

Data Bits 8

Parity ....Odd

Stop Bits 1

Protocol ....CDI 300

Connector .... DE9 female

Aux Port A (Future use)

Interface ....RS-232 (point-to-point) or RS-485 (point-to-point or multidrop)

Baud Rate 1200, 2400, 4800, 9600, 19.2K, 38.4K

Data Bits 7, 8

Parity ....None, Odd, Even

Stop Bits 1, 2

Protocol .... Unused

Connector .... DE9 Female (RS-485) DE9 Male (RS-232)

Aux Port B (Programming / Configuration)

Interface.. RS-232 (point-to-point)

Baud Rate .... Auto Detect 1200, 2400, 9600, 19.2K

Data Bits 8

Parity ....None

Stop Bits 1

Protocol ....ACSII / Programming CDI 310 / Configuration

Connector .... DE9 male

Power Supply

Voltage .... Selectable 120VAC or 240VAC

Frequency.. 50/60 Hz

Load 12VA

Fuse... 0.5A 250V ABC

Connector..IEC standard power cord

Mechanical

Dimensions ....3"H X 10.16"W X 11.55"D

Weight... 4 pounds

Environmental

Operating Temperature .... 0°C to 50°C

Storage Temperature ....-30°C to 70°C

Humidity ....5% to 95% (non-condensing)

Front Panel

The front panel of the CDI 310 (pictured below) has several LED indicators. The function of each indicator is described below.

Figure 2-1 Front Panel
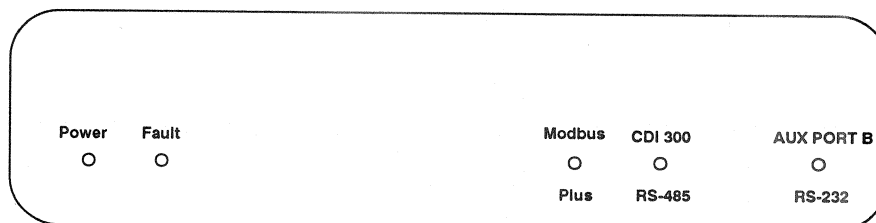
Power Indicator   This green LED has Flash codes that indicate various conditions. The indicator is illuminated during the self-test for lamp-test purposes.

The following codes are valid after the internal self-test is complete (about 2 seconds after power-up or reset).

Table 2-1 Power Indicator Flash Codes

Flash Code	Meaning
Solid	Self-diagnostics passed, downloaded application module has control.
1 flash	ROM checksum error, unit should be returned for repair.
2 flashes	RAM data error, unit should be returned for repair.
3 flashes	RAM address error, unit should be returned for repair.
4 flashes	Dual port RAM data error, unit should be returned for repair.
5 flashes	Dual port RAM address error, unit should be returned for repair.
6 flashes	Application code is not present. Appropriate application code must be downloaded into the CDI 310 using the resident loader to clear this error. If this error does not clear following application download, the unit should be returned for repair.
7 flashes	Internal error, unit should be returned for repair.

Fault Indicator   The fault indicator is used by the downloaded application module. Refer to the appropriate application module documentation for fault indicator flash codes.

This indicator is illuminated during the self-test for lamp-test purposes.

Table 2-2 Fault Indicator Flash Codes

Flash Code	Meaning
1 flash	Invalid Parameters, run the configuration utility to set the operating parameters. If this fault does not clear it may indicate an internal hardware failure
2 flashes	Invalid Modbus Plus node number. The factory default parameters are designed to generate this error to prevent possible corruption of the Modbus Plus network by an incorrectly configured unit. The unit must have a Modbus Plus address configured before this error will clear.
3 flashes	Modbus Plus interface RAM error, unit should be returned for repair.
4 flashes	Modbus Plus interface unresponsive, unit should be returned for repair.
5 flashes	Modbus Plus interface internal failure, unit should be returned for repair.
6 flashes	Modbus Plus interface diagnostic failure, the unit should be returned for repair.
7 flashes	Modbus Plus interface run-time error. Contact the factory with details of the circumstances that resulted in this error. This error may be cleared by resetting the unit.
8 Flashes	Invalid CDI 300 station address. The factory default parameters are designed to generate this error to prevent possible corruption of the CDI 300 network by an incorrectly configured unit. The unit must have a CDI 300 station address configured before this error will clear.

Modbus Plus Indicator

This indicator has the standard Modbus Plus flash codes. Please note that this indicator DOES NOT illuminate during the self-test.

Table 2-3 Modbus Plus Indicator Flash Codes

Flash Code	Meaning
6 flashes per Second	The node's normal operating state. The node is successfully receiving and passing the token. All nodes on the link should be flashing this pattern.
1 flash per Second	This node is off-line after just being powered up, or after hearing a message from another node with the same network link address (duplicate addresses are not allowed). In this state, the node monitors the network and builds a table of active nodes and token-holding nodes. It remains in this state for 5 seconds, then attempts to go to it's normal operating state.
2 flashes, then off for 2 Seconds	The node is hearing the token being passed among the other nodes, but is never receiving the token. Check the network link for an open or short circuit, or defective termination.
3 flashes, then off for 1.7 Seconds	The node is not hearing any other nodes. It is periodically claiming the token, but finding no other node to pass it to. Check the network link for an open or short circuit, or defective termination.
4 flashes, then off for 1.4 Seconds	The node has heard a valid message from another node that is using the same address as this node. The node remains in this state as long as it continues to hear the duplicate address. If the duplicate address is not heard for 5 seconds, the node then changes to the pattern of 1 flash every second.

CDI 310 Port Indicator

The CDI 300 port indicator is illuminated whenever the unit is transmitting on the CDI 300 network. If the network is operating correctly, this indicator will be flashing.

This indicator is illuminated during the self-test for lamp-test purposes.

Aux. Port A Indicator

Aux. Port A is reserved for future use.

This indicator is illuminated during the self-test for lamp-test purposes. Note: The Aux. Port A indicator is below the front label, and is invisible.

Aux. Port B Indicator

This indicator is reserved for use by the bootstrap loader and is illuminated until the power-up / reset self-test is completed. If a terminal device is connected, this indicator will flash for each character received until the baud rate is detected. Once the baud rate has been detected, this indicator will be on and the CDI 310 will be in configuration/load mode.

Power Entry Module

The CDI 310 receives power via an IEC standard power entry module and can be configured for either 120V AC or 240V AC (50/60 Hz) operation. The power entry module also incorporates an on/off switch and fuse holder.
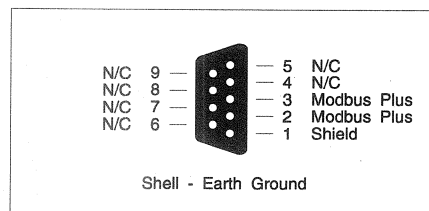
Figure 2-2 Power Entry Module

IEC POWER CONNECTOR

POWER SWITCH

VOLTAGE SELECTOR & FUSE
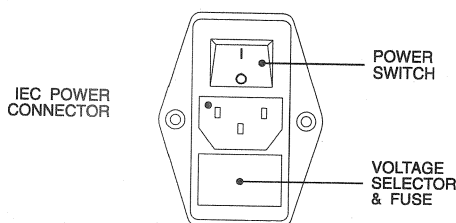
Modbus Plus Port

The Modbus Plus port is a female 9 pin 'D' connector at the rear of the unit. The pin connections are outlined below.
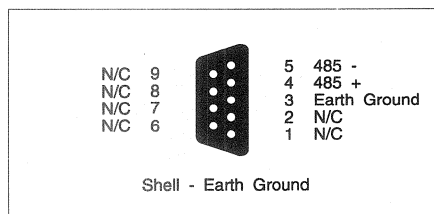
Figure 2-3 Modbus Plus Connector

```
N/C  9 —          — 5  N/C
N/C  8 —          — 4  N/C
N/C  7 —          — 3  Modbus Plus
N/C  6 —          — 2  Modbus Plus
                  — 1  Shield

       Shell - Earth Ground
```

CDI 300 Port

The CDI 300 Port is a high-speed RS-485 interface and has a female 9 pin 'D' connector at the rear of the unit. The pin connections are outlined below.

This port has a built-in terminating resistor that may be connected by setting the switch to the left of the port connector in the up position. Only the first and last units on a CDI 300 network should have the terminating resistor enabled.

Figure 2-4 CDI 300 Communications Port Connector

```
N/C  9          5  485 -
N/C  8          4  485 +
N/C  7          3  Earth Ground
N/C  6          2  N/C
                1  N/C

       Shell - Earth Ground
```
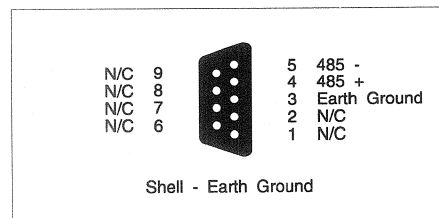
Auxiliary Port 'A' (RS-485/RS232)

Auxiliary Port 'A' is not used. The port has two connectors in the back of the CDI 310, which are described in details below. For the CDI 310 use, there is no need to connect anything to these ports.

Auxiliary Port 'A' is a medium speed port and has two connectors at the rear of the unit providing either RS-232 or RS-485 connections. The RS-485 Connector is a female 9 pin 'D' and the RS-232 is a male 9 pin 'D'. The pinouts for both connectors are outlined below.
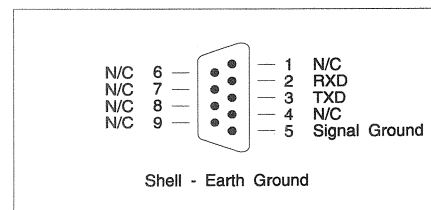
The RS-485 port has a built-in terminating resistor enabled by setting the switch to the left of the port connector UP. Only the first and last units on an RS-485 link should have the terminating resistor enabled. **This switch must be down if the RS-232 connector is used!**

Figure 2-5 Auxiliary Port 'A' RS-485 Connector


```
N/C  9        5  485 -
N/C  8        4  485 +
N/C  7        3  Earth Ground
N/C  6        2  N/C
              1  N/C

     Shell - Earth Ground
```

The function of this port is defined by the application module. Refer to the documentation for each application module for specific information on the operation of this port. For the CDI 310 module, there is no use of the Auxiliary Port A.
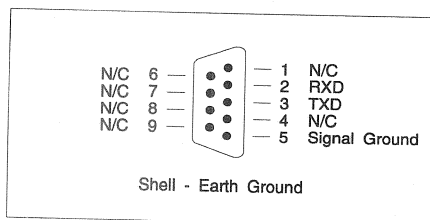
Figure 2-6 Auxiliary Port 'A' RS-232 Connector


```
N/C  6 —      — 1  N/C
N/C  7 —      — 2  RXD
N/C  8 —      — 3  TXD
N/C  9 —      — 4  N/C
              — 5  Signal Ground

     Shell - Earth Ground
```

Auxiliary Port 'B' (RS-232)

Auxiliary port 'B' is the RS-232 programming/configuration port and has a male 9 pin 'D' connector at the rear of the unit. The pin connections are outlined below.

Figure 2-7 Auxiliary Port 'B' Connector


```
N/C   6 —         — 1   N/C
N/C   7 —         — 2   RXD
N/C   8 —         — 3   TXD
N/C   9 —         — 4   N/C
                  — 5   Signal Ground

        Shell - Earth Ground
```

This port is used by the bootstrap loader to permit new applications to be downloaded into the FLASH ROM.

This port is also used by the CDI 310 application to permit configuration information to be altered. The CDI 310 configuration utility (DOS based) should be used to configure the unit.

This chapter describes the hardware installation for the CDI 310 gateway.

The hardware installation includes the electrical power connections to the gateway, the CDI 300 link installation, and the proper connections for the configuration port.

Fuse Installation & Voltage Selection

The fuse is located in the voltage selector of the power entry module at the rear of the unit. When the power cord is removed a screwdriver or other small bladed tool may be used to pry the voltage selector out.

There is space for 2 fuses in the voltage selector, however the normal configuration (120/240V) only uses one. The other fuse position may be used to store a spare fuse.

Note that different fuse position is used for 120V and 240V operation, and the voltage selector will slide back into the power entry module two ways.

European Dual Fusing

The CDI 310 has provisions for European dual fusing (using the second fuse position), however when configured for this option, it will support 240V operation only.

Contact the factory for further information.

The recommended solution is to use a standard unit with a dual-fused IEC power cord compatible with the destination country.

120V 50/60Hz (single fuse) Operation

Install the voltage selector module as illustrated below for 120V operation. Note that the fuse is installed in the opposite side of the voltage selector block than for 240V single fuse operation.
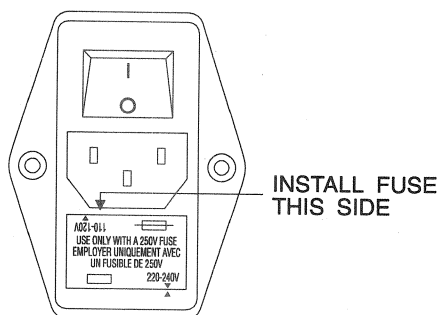
Figure 3-8 120V Operation
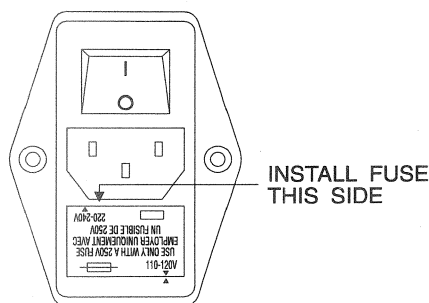
INSTALL FUSE
THIS SIDE

Use only type ABC 250V 0.5A fuse, improper setting of voltage selector may cause serious damage to the unit!

240V 50/60Hz (single fuse) Operation

Install the voltage selector module as illustrated below for 240V operation. Note that the fuse is installed in the opposite side of the voltage selector block than for 120V operation.

Figure 3-9 240V (Single Fuse) Operation

INSTALL FUSE
THIS SIDE

IMPORTANT! Use only type ABC 250V 0.5A fuse, improper setting of voltage selector may cause serious damage to the unit!

Cable Requirements

Modbus Plus Port

Only Modicon approved cable and connectors should be used to connect the CDI 310 to a Modbus Plus network. This device connects the same as any other Modbus Plus device.

CDI 300 Port

The CDI 300 ports should be connected using single twisted pair shielded cable (Belden 9844 or equivalent). Use only metal 'D' shell hoods to maintain the shielding continuity around the connectors. Ensure that the shield is only connected to ground at one point. The unconnected end of the shield should be insulated to prevent inadvertent connection to the 'D' shell hood. The shield pin is internally connected to the shell of the connector, and the cabinet of the CDI 310.

Please note that the CDI 300 pins are polarized and that the link will not function if the polarity is incorrect.

Figure 3-10 CDI 300 Cable

Ground	3	
485 +	4	Belden 9842
485 -	5	or equivalent
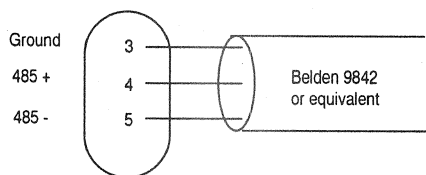
Other pins unconnected. Connect the shield to the drive, screw 7 or 3 as in CDI 300 manual.

The first and last nodes on a CDI 300 network should have a terminating resistor. The CDI 310 has a built-in terminating resistor which is enabled when the switch beside the CDI 300 connector is up.

Aux Port B   Aux port B should be connected using 3 conductor shielded cable (Belden 9925 or equivalent). Use only metal 'D' shell hoods to maintain the shielding continuity around the connectors and connect only 1 end of the shield to the shell of the connector. The unconnected end of the shield should be insulated to prevent inadvertent connection to the 'D' shell hood.

DO NOT connect the signal common to the shield or connector shell. The signal common should be connected to one of the 3 conductors in the cable.

The following cable should be used to connect the CDI 310 to an IBM compatible computer for programming/configuration operations.

Figure 3-11 9 pin Programming/Configuration Cable
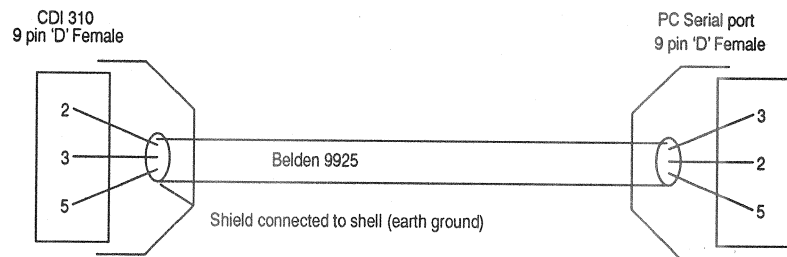
Figure 3-12 25 pin Programming/Configuration Cable
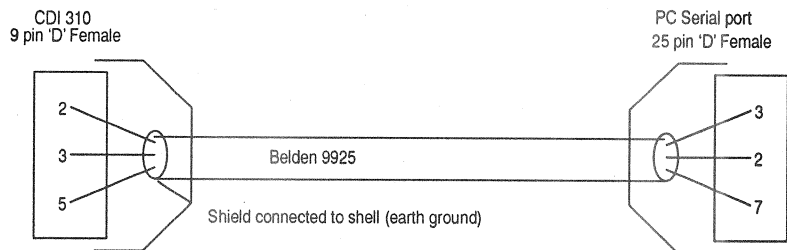
Mounting   The standard unit is equipped with both rubber feet for unrestrained mounting and shock mounts for fixed mounting. To install the shock mounts, pry the rubber feet out of the threaded inserts on the bottom of the unit and screw in the supplied shock mounts.

When the shock mounts are used, four 10-32 machine screws should be used to attach the unit via the threaded holes in the bottom of the shock mounts.

The CDI 310 may be mounted in any orientation, however in high shock or vibration applications, it should be mounted such that the plane of the shock is parallel with the base of the unit.

Chapter 4 – Software Installation

This chapter provides information about the installation and configuration of the CDI 310.

Introduction

The application software that controls the operation of the CDI 310 is stored in FLASH memory. This permits updated versions of the software to be installed in the field without opening the unit and replacing chips. The CDI 310 has a built-in loader that performs the application software download. This utility is contained in the permanent ROM of the CDI 310 and cannot be erased. The sole function of the loader is to permit application modules to be programmed into the Flash ROM.

Things you need

- An IBM PC or compatible computer with a standard serial port.

- DOS based configuration utility (CDI310.EXE).

- A new or updated application module file (CDI310.HEX).

- A serial interface cable as described earlier.

Starting CDI310.EXE

Several options may be specified on the command line when CDI310.EXE is started. These options specify alternate serial ports and /or baud rates. If no options are specified CDI310.EXE will use COM1: at 9600 baud. The CDI310 will automatically detect the baud rate being used, so it is advantageous to use the highest baud rate that works reliably on your machine.

Comm Port

The serial port may be set to COM1 or COM2 using the /PX switch on the command line. Use /P1 to select COM1 or /P2 to select COM2. If this switch is not specified on the command line COM1 is used (i.e. /P1).

Baud Rate

The /BXXXX command line switch lets you select the communication baud rate. You may use any of; 1200, 2400, 4800, 9600 or 19200. If this switch is not specified on the command line 9600 baud is used (i.e. /B9600).

Help

A list of available command line switches may be displayed using the '?' command.

To display a list of loader commands

```
CDI310 ?
```

Example To use COM2 at 19200 baud

```
CDI310 /P2 /B19200
```

To use COM2 at 1200 baud

```
CDI310 /P2 /B1200
```

To use COM1 at 4800 baud

CDI310 /B4800 /P1 or

```
CDI310 /B4800
```

Terminal Mode

CDI310.EXE starts in terminal mode. In this mode, the software is acting as a ASCII terminal. This mode is used to communicate with the CDI 310 resident loader and download application software modules.

Terminal mode operates the same as an ASCII terminal. Information received on the serial port is displayed on the screen, and characters typed on the keyboard are transmitted. This limited terminal emulation is all that is required to download application software into the CDI 310.

Returning to DOS

You may exit terminal mode at any time and return to DOS by pressing [F10]

Establishing Communications

There is a 5 second time window immediately after reset when the CDI 310 is checking for incoming data on the configuration port. If activity is detected, the CDI 310 detects the baud rate and enters config/loader mode.

To establish communications

• Reset the CDI 310 by turning the power off and back on again

• Press [Enter] several times until the CDI 310 issues the prompt "Configuration or Loader [C/L]?". If you wait too long, or don't press enter enough times, the CDI 310 will not detect the config port activity and will continue with normal start-up.

• Instead of pressing [Enter] several times, the function key [F9] can be pressed. This will send continuously [Enter] keystrokes to the gateway, until a connection is established.

• Once the prompt is displayed the CDI 310 has detected the baud rate and communications are now established. You may continue on to download application software or configure the CDI 310.

Although the loader functions are described in details below, these functions are not intended for a customer use. The loader functions are for ABB Drives personnel use only. Damage to the downloaded application can result from a misuse of the loader functions.

Downloading Application Software

The loader is used to download application software into the CDI 310's FLASH ROM. This only needs to be done when new or updated software is to be installed.

Starting the Loader

The loader has several commands that permit the FLASH ROM to be erased and reloaded with new application software.

To start the loader

- After establishing communications press "L" to select the loader. A message will be displayed indicating the version of the resident loader followed by a prompt ":".

Getting Help

A list of loader commands may be displayed using the '?' command.

To get help on loader commands

- Press '?' and [Enter]

Erasing the FLASH ROM

The 'E' command will erase the FLASH ROM. **Make sure you have an application software module (CDI310.HEX) before you erase the FLASH ROM.**

To erase the FLASH ROM

- Press 'E' and [Enter]

- A warning message will be displayed to verify the command. Press 'Y' to erase or 'N' to abort the command (just press 'Y' or 'N' you do not need to press [Enter]).

Programming the
FLASH ROM

The 'P' command will program the FLASH ROM. The FLASH ROM should be erased before programming.

To program the FLASH ROM

- Press 'P' and [Enter]

- A warning message will be displayed to verify the command. Press 'Y' to continue programming or 'N' to abort the command (just press 'Y' or 'N' you do not need to press [Enter]).

- The prompt "Programming" is displayed to indicate that the loader is ready for the application module to be downloaded.

- Press [F2] to download the application module. You will be prompted for the application module file name. Be sure to include the drive letter and path if the file is not located in the same directory as CDI310.EXE.

- While the CDI 310 is programming, a "." will be output for each record received to indicate progress. It is normal for about one screen full of "."'s to be output before the download is complete.

To abort the program command

- Once the "Programming" prompt is displayed the CDI 310 will wait indefinitely for the first character to be received. Once the first character is received a 100 ms time-out is used. To abort the program command before the download is started, just press any key and the command will time out and fail.

- If the download has been started, you may abort by pressing [Ctrl]-[Break]. The program command will time out and fail. The FLASH ROM should be erased before attempting the program command again.

Troubleshooting

- If the program command times out part way through, the baud rate is probably too high. Try again with a lower baud rate (you must restart CDI310.EXE at the lower baud rate and re-establish communications).

- If the Program command fails immediately, you probably pressed [Enter] after answering 'Y' to the warning message.

Verifying the FLASH ROM

The 'V' command will program the FLASH ROM. This command is identical to the program command except that the downloaded application module is verified against the contents of the FLASH ROM instead of being programmed into it.

Exiting the Loader

The 'Q' command will exit the loader and restart the CDI 310.

To exit the Loader

- Press 'Q' and [Enter]

- The CDI 310 will go through it's reset cycle during which you may re-establish communications by pressing [Enter] several times. Since the CDI 310 application software requires configuration data, this is usually entered immediately after programming.

Configuring the CDI 310

The CDI 310 application module has a configuration utility that works with CDI310.EXE's config mode to upload and download configuration data. This configuration data is stored in non-volatile memory. CDI310.EXE has several commands to edit the configuration data and save it on disk.

To put the CDI 310 into config mode

- After establishing communications press 'C' to select config mode.

- This puts the CDI 310 into config mode. This mode will only communicate with CDI310.EXE's config mode.

To put CDI310.EXE into config mode

- Press F1 to select Cnfg. This puts CDI310.EXE into config mode.

- This mode is used to modify the configuration data in a CDI 310. It may operate in either on-line or off-line mode.

Off-line Config Mode

Off mode is automatically selected if a CDI 310 is not connected or not in config mode. Off-line mode is provided to permit configuration data to be edited and saved without a CDI 310 connected. Most of the commands are disabled in off-line mode.

On-line Config Mode

On-line mode is automatically selected if a CDI 310 (in config mode) is detected. If any unrecoverable communication errors occur in on-line mode, CDI310.EXE will switch to off-line mode.

Load Config Data from Disk

This command permits configuration data be loaded from disk. After a load, the config data will be in memory and may be downloaded to the CDI 310 and edited.

To load configuration data from disk

- Press F1 to select Load

- Type in the filename and press [ENTER] or press [ESCAPE] to cancel

- The file will be read into memory

- The success or failure of the command will be displayed in the upper right corner of the screen.

Save Config Data to Disk

This command permits configuration data to be saved to disk. After being saved, the config data is still in memory and may be downloaded to the CDI 310 and edited.

To save configuration data to disk

- Press F2 to select Save

- Type in the filename and press [ENTER] or press [ESCAPE] to cancel

- The file will be read into memory

- The success or failure of the command will be displayed in the upper right corner of the screen.

Upload Config Data from CDI 310

This command is only available in on-line mode and will upload configuration data from the CDI 310. After being uploaded, the config data is in memory and may be edited and saved to disk.

To upload configuration data from a CDI 310

- Press F3 to select Upld

- The success or failure of the command will be displayed in the upper right corner of the screen.

Download Config Data to CDI 310

This command is only available in on-line mode and will download the configuration data in memory to the CDI 310. After being downloaded, the config data is still in memory and may be edited and saved to disk.

To download configuration data to a CDI 310

- Press F4 to select Dnld

- The success or failure of the command will be displayed in the upper right corner of the screen.

Edit Configuration Data

This command is only available in on-line mode and will start the configuration editor. Refer to the section on Edit Mode for more information. After being edited, the modified config data is in memory and may be downloaded and/or saved to disk.

To enter edit mode

- Press F5 to select Edit

Set CDI 310 to Factory Default

This command is only available in on-line mode and will set the CDI 310 to factor default configuration. This command will not affect the configuration data currently in memory.

To set a CDI 310 to factory default

- Press F6 to select Dflt

- The success or failure of the command will be displayed in the upper right corner of the screen.

Get CDI 310 Software Revision

This command is only available in on-line mode and will display the software revision level of the CDI 310. This command will not affect the configuration data currently in memory.

To display the software revision level of the CDI 310

- Press F7 to select Rev.

- The revision level or an error message will be displayed in the upper right corner of the screen.

Reset the CDI 310

This command is only available in on-line mode and will reset the CDI 310 (same as power off/on). After this command is executed, off-line mode is automatically selected.

To reset the CDI 310

- Press F8 to select Reset

- The success or failure of the command will be displayed in the upper right corner of the screen.

Return to Terminal Mode

This command will terminate Config Mode returning to Terminal Mode. If configuration data has been uploaded or edited and not downloaded or saved, a warning will be issued to prevent the loss of configuration information.

To return to Terminal Mode

- Press F10 to select Exit

- If you have not saved or downloaded the configuration data, a warning will be displayed. Answer [N] to stay in Config mode or [Y] to abandon the config data and return to terminal mode.

Edit Configuration Data This mode lets the user display and edit configuration data. Edit mode actually uses a copy of the configuration data currently in memory. Changes made in edit mode are not stored in memory until edit mode is terminated. A cancel option is available to leave edit mode without updating the configuration data in memory. Even after changes have been accepted, only the configuration data in memory will be modified. The configuration data in the CDI 310 (if connected) will not be updated unless the user specifically does so (see Configuring the CDI 310).

Displaying the Config Data The configuration data is displayed on 7 pages. The [PgUp] and [PgDn] keys may be used to display the various pages. The format of the data is described in the following sections.

Changing the Modbus Plus Parameters The only Modbus Plus parameter is the node number. This value may be from 1-64 and sets the Modbus Plus station address for this node. Other devices use this node number when sending messages to the CDI 310. See Modbus Plus Compatibility for more information on Modbus Plus addressing.

To set the Modbus Plus node number

- Press [F1] to select MBP

- If the node number is already set, it will be displayed in square brackets. Enter the new node number, or press [Enter] to accept the current value.

- Pressing [Esc] at any time will abort without changing the Modbus Plus parameters.

- The default Modbus Plus node number is 0 which is invalid. This is to prevent the CDI 310 going active on the Modbus Plus network without being configured. The CDI 310 will generate an invalid parameters fault (1 flash on the fault LED) if it is started with the factory default Modbus Plus node number.

Changing the CDI 300 Parameters

The CDI 300 parameters are the CDI 300 station address and the device name. The station address may be set to 0-31 and is used by other CDI 300 stations when sending messages to this station. If the station address is 0, the CDI 310 operates as a self-configuring bus administrator. The device name (8 characters) identifies this station to other devices on the CDI 300 network.

The set-node-name command may be used to change the name of this device device name from the CDI 300 network.

To set the CDI 300 parameters

- Press [F2] to select CDI

- A prompt is issued for the CDI 300 station address, if this value is already set, it will be displayed in square brackets. Enter the new station address, or press [Enter] to accept the current value.

- A second prompt is issued for the device name, if this value is already set, it will be displayed in square brackets. Enter the device name, or press enter to accept the current value.

- Pressing [Esc] at any time will abort without changing the CDI 300 parameters.

- The default CDI 300 station address is 32 which is invalid. This is to prevent the CDI 310 going active on the CDI 300 network without being configured. The CDI 310 will generate an invalid parameters fault (1 flash on the fault LED) if it is started with the factory default CDI 300 station address.

Configuring Data Sets Up to 128 data sets may be configured for input or output. The default condition for data sets is disabled.

Data set display The data set configuration is displayed on pages 2–5 of the configuration software. The first column is the data set number, followed by the type (I = input, O = output, blank = disabled). For output data sets the last two columns display the data set size (in bytes) and update interval in seconds. For disabled and input data sets, the last two columns are blank.

Configuring a data set

- Press [F3] to select D.S.

- A prompt is issued for the data set number. Enter the data set number and press [Enter].

- A prompt is issued for the data set type. Press 'I' for input, 'O' for output or 'X' for disabled. You do not need to press [Enter].

- For output data sets a second prompt is issued for the data set size in bytes, if this value is already set, it will be displayed in square brackets. Enter the data set size, or press enter to accept the current value.

- For output data sets a third prompt is issued for the data set interval in seconds, if this value is already set, it will be displayed in square brackets. Enter the update interval in seconds (decimal values permitted), or press enter to accept the current value.

- Pressing [Esc] at any time will abort without changing the data set configuration.

Configuring High Speed Control Data

Up to 32 words of data may be copied from the Modbus Plus network global data to any word(s) in any outgoing data set(s). Care should be taken that only data sets configured for output are referenced. If a disabled or incoming data set is referenced, the control data word will not make it onto the CDI 300 network.

Global Data cannot pass through most MBP bridge nodes, the global data must originate in a node on the local MBP network.

Control data configuration display

The control data configuration is displayed on page 6 of the configuration software. The first column is the control data word number. Each control data word has a source Modbus Plus node and global data word number and a destination data set and data set word number. Control data words that are not used have blanks for all of these parameters.

The control data configuration may be read as "Copy global data from Modbus Plus node {MBP Node} word number {Word} to output data set number {D.S.} word number {Word}"

To configure a control data word

- Press [F4] to select Cont.

- A prompt is issued for the control data word number. Enter the word number and press [Enter].

- A prompt is issued for the source Modbus Plus node number. If this value is already set, it will be displayed in square brackets. Enter the Modbus Plus address of the source node, press [Enter] to accept the current value or enter 0 to disable the control data word.

- If the control data word is not disabled, a prompt is issued for the global data word number, if this value is already set, it will be displayed in square brackets. Enter the source global data word number, or press enter to accept the current value.

- Following the global data word number, a prompt is issued for the destination data set number, if this value is already set, it will be displayed in square brackets. Enter the destination data set number, or press enter to accept the current value.

- Finally, a prompt is issued for the destination data set word number, if this value is already set, it will be displayed in square brackets. Enter the destination data set word number, or press enter to accept the current value.

- Pressing [Esc] at any time will abort without changing the control data configuration.

Configuring High Speed Status Data

Up to 32 words of high speed status data may be output to the Modbus Plus network as global data. This data may be taken from any data set(s) received from the CDI 300 network.

These 32 words of global data are transmitted on the MBP every token rotation and are available to all nodes on the local MBP network.

Global Data cannot pass through most MBP bridge nodes, only the nodes on the local MBP network will receive the data.

Status data configuration display

The status data configuration is displayed on page 7 of the configuration software. The first column is the source data set number followed by the data set word number. The last column is the global data word number. Status data words that are not used have blanks in the first two columns.

The status data configuration may be read as "Copy input data set number {D.S.} word number {Word} to Modbus Plus global data output word number {Global Word}"

To configure a status data word

• Press [F5] to select Stat.

• A prompt is issued for the output global data word number. Enter the word number and press [Enter].

• A prompt is issued for the source data set number. If this value is already set, it will be displayed in square brackets. Enter the source data set number, press [Enter] to accept the current value or enter 0 to disable the status data word.

• If the status data word is not disabled, a prompt is issued for the source data set word number, if this value is already set, it will be displayed in square brackets. Enter the source data set word number, or press enter to accept the current value.

• Pressing [Esc] at any time will abort without changing the control data configuration.

Clearing Configuration to Default

This command will clear the configuration data to factory default.

To clear the configuration data

• Press [F6] to select Clear

• A warning will be issued to prevent accidental clearing of data. Type 'Y' to clear the configuration data. Type 'N' or hit [Esc] to abort the command.

Discarding Changes and Returning to Config Mode

This command will discard all changes made to the configuration data and return to configuration mode.

To discard changes and return to Configuration Mode

• Press [F9] to select Cancel

• A warning will be issued to prevent accidental loss of data. Type 'Y' to discard changes and return to configuration mode. Type 'N' or hit [Esc] to abort the command.

Accepting Changes and Returning to Config Mode

This command will update the configuration data in memory and return to configuration mode. The updated configuration data may be downloaded, or saved using configuration mode commands.

To accept changes and return to Configuration Mode

• Press [F10] to select Done

This chapter describes the Modbus Plus network compatibility issues. This section will also describe all the Modbus Plus services, which are supported by the gateway.

The CDI 310 may be accessed like a Modicon 984 controller with the exception that only a subset of the Modbus Plus commands are supported.

Data Access Commands

Only the 4XXXX memory access commands are supported. Attempts to access the CDI 310 using other commands will return unsupported command exception responses.

These commands must be addressed with an additional path byte appended to the normal Modbus Plus address. This path byte must be in the range 1-8. If multiple Modbus Plus devices are accessing the CDI 310, or multiple concurrent messages are sent from one device, higher throughput will be achieved if each uses a different path within the CDI 310.

Table 5-4 Supported Data Access Commands

Command Code	Description
03H	Read holding registers. This command will read one or more of the registers in the virtual 984 4XXXX memory space. Only addresses listed in the Virtual 984 memory map may be accessed. Attempts to access other addresses will return an invalid address exception response.
06H	Preset single register. This command will write one register in the virtual 984 4XXXX memory space. Only addresses listed in the Virtual 984 memory map may be accessed. Attempts to access other addresses will return an invalid address exception response.
10H	Preset multiple registers. This command will write one or more of the registers in the virtual 984 4XXXX memory space. Only addresses listed in the Virtual 984 memory map may be accessed. Attempts to access other addresses will return an invalid address exception response.

Data Access Commands Addressing Example

If the CDI 310 Modbus Plus node number is 20, data access commands should be directed to 20.1 through 20.8.

If a bridge node (#33) is between the sending node and the CDI 310, the addressing should be 33.20.1 through 33.20.8.

Get Node Statistics

This special Modbus Plus command must be sent without a path number appended to the normal Modbus Plus address.

The reply will contain the standard Modbus Plus interface statistics.

Get Node Statistics Command Addressing Example

If the CDI 310 Modbus Plus node number is 20, the node statistics access command should be directed to 20.

If a bridge node (#33) is between the sending node and the CDI 310, the addressing should be 33.20.

Virtual 984 Memory Map

All of the data sets are laid out in a virtual 984 memory map. For any given data set, the 984 4XXXX address may be determined from this table.

Table 5-5 Virtual 984 Memory Map

984 Address	Data Item	Description
40001 - 40128	Data Set Size	Each word contains the size of the corresponding data set, zero if data set is not present. This data should not be written to.
40129 - 40144	Data Set 1	CDI 300 data set #1. 32 bytes organized as 16 words, the actual byte count is contained in register 40001.
40145 - 40160	Data Set 2	CDI 300 data set #2. 32 bytes organized as 16 words, the actual byte count is contained in register 40002.
. . .	. . .	. . .
42161 - 42176	Data Set 128	CDI 300 data set #128. 32 bytes organized as 16 words, the actual byte count is contained in register 40128.

Incoming Data Sets   Data sets configured for input will be updated from the CDI 300 network at the data set update interval. Data written to these data sets will be overwritten the next time the data set is received from the CDI 300 network. This should be avoided to prevent invalid data being sent to other Modbus Plus nodes reading these data sets.

Outgoing Data Sets   Data sets configured for output will be written to the CDI 300 network at the data set update interval. Data written to these data sets will be output the next time the data set is transmitted to the CDI 300 network.

These data sets may also be read back.

Use care when writing to outgoing data sets to prevent overwriting data words referenced by the high speed control data. These words are updated from the source Modbus Plus global data at regular intervals.

Disabled Data Sets   Disabled data sets will neither be written to or read from the CDI 300 network.

Appendix A – Example

This chapter describes one example configuration for the use of the Modbus Plus gateway with the ACS 500 drives.

This chapter is intended for people who are new to use the Modbus Plus gateway CDI 310, or are new in using the CDI 300 link with the ACS/ACH 500 drives.

Overview

In this example, there are 10 drives connected to the CDI 300 network. There is one CDI 310 gateway doing the drive control and monitoring. Each one of the drives is receiving the following information:

- Start, Stop, Reset, and Direction control from the gateway,

- Frequency reference from the gateway.

Each one of the drives is sending the following information to the gateway:

- The drive status using the status word,

- The Drive frequency actual.

This example is one possible way of doing these functions.

CDI 310 Setup

The CDI 310 has to be setup to both receive and transmit the required data on the CDI 300 network. All of this is done using the dataset services. The following setups need to be done. These station numbers are a suggestion, actual numbers can be different.

- Modbus Plus station number 2

- CDI 300 station number 0

- CDI 300 station name "Gateway"

The CDI 310 is programmed to send one control word, and one frequency reference per drive. The maximum size for one dataset is 8 words, so we will pack control for 4 drives in one dataset. This will cause a total of 3 datasets to be sent out to the CDI 300 network.

For the CDI 310, the following configuration is needed for the outgoing datasets:

Table A-6 Outgoing Dataset Configuration

Dataset number	Input/Output	Interval [s]	Length [bytes]
5	O	0.5	16
6	O	0.5	16
7	O	0.5	8

In this table, the interval is in seconds, and the length is in bytes.

For the CDI 310, the following configuration is needed for the incoming datasets:

Table A-7 Incoming Dataset Configuration

Dataset number	Input/Output
11	I
12	I
13	I
...	...
20	I

The interval, and the dataset length are actually defined by the sending station. In this example we have presumed that the following data mapping is being used:

Dataset 5 contains the following information in order

- Drive 1 control word

- Drive 1 frequency reference

- ...

- Drive 4 control word

- Drive 4 frequency reference

Dataset 6 contains the following information in order

- Drive 5 control word

- ...

- Drive 8 frequency reference

Dataset 7 contains the similar information for drives 9 and 10.

For the incoming information, it is presumed, that drive 1 sends dataset 11, and the last drive, 20, sends dataset 20.

ACS 500 Setup

On the ACS 500 setup, there is a need to program the drive to both receive and use the incoming control information, and also to send out the required outgoing data.

For the programming of the drives, it is safe to first load the factory macro after changing the EEPROM. After this, the following changes should be made:

- Operating data, CONTROL LOCATION to EXTERNAL

- 10.1.1 EXT 1 STRT/STP/DIR to STD COMM. This will define the standard communication for the external control source.

- 10.1.3 LOC/EXT DIRECTION to REQUEST, if the direction control is needed.

- 10.2.2 EXTERNAL REF1 SEL to STD COMM. to use the incoming reference from the serial communication.

- 10.4.2 FAULT RESET SELECT to STD COMM.

- 10.8.1 DRIVE ID-NUMBER. Set this to values 1 for the first drive, 2 for the second drive, and 10 for the last drive.

- 10.8.3 CONTROL SOURCE. See the *CDI 300 Installation & Start-up Manual*. A typical setup would be 32, which is indicating that the "toggling bit" is used for detecting serial communication losses.

- 10.8.4 COMMS FAULT FUNCT. Select NONE, FAULT, or FAULT+STOP as a communication fault action.

- 10.8.7 DATASET 1 WRIT ID. Set this to 11 for the drive 1, and 20 for the drive 10. This is identifying the dataset number, which the drive is sending out.

- 10.8.8 DATASET 1 W CYCLE. Set this to 1000 ms. This is identifying how often the drive is sending out its dataset.

- 10.8.9 DATASET 1.1 WRITE. Set this to 5/01/01. This is identifying that the drive is sending out on the dataset the status word as the first word going out.

- 10.8.10 DATASET 1.2 WRITE. Set this to 0/00/01. This will specify, that the drive is sending out as the second word the actual drive frequency to the gateway.

- 10.8.27 DATASET 1 READ ID. Set this to 5, 6, or 7. Depending on the drive number.

  - Drives 1-4, 5
  - Drives 5-8, 6
  - Drives 9-10, 7

  This is identifying what dataset the drive will receive its controls from.

- 10.8.28 DATASET 1.1 READ – 10.8.35 DATASET 1.8 READ. These parameters will tell to the drive, how to use the incoming dataset contents. We have setup the control so that each one of the drives will have a unique control (dataset and a word within a dataset). The following setup could be used:

  - Drives 1, 5, 9   `10.8.28 CMD WORD, 10.8.29 EXT REF 1`
  - Drives 2, 6, 10   `10.8.30 CMD WORD, 10.8.31 EXT REF 1`
  - Drives 3, 7   `10.8.32 CMD WORD, 10.8.33 EXT REF 1`
  - Drives 4, 8   `10.8.34 CMD WORD, 10.8.35 EXT REF 1`

These setups will make the controls unique, for the drives are receiving separate datasets.

Address Mapping   Using the setups presented above, the following Modbus Plus side register addressees are now available for the register reads and writes from the Modbus Plus side

Table A-8 Modbus Plus addresses

Modbus Plus	Description
40193	Drive 1 control word
40194	Drive 1 frequency reference
40195	Drive 2 control word
40196	Drive 2 frequency reference
40197	Drive 3 control word
40198	Drive 3 frequency reference
40199	Drive 4 control word
40200	Drive 4 frequency reference
40209	Drive 5 control word
40210	Drive 5 frequency reference
...	...
40216	Drive 8 frequency reference
40225	Drive 9 control word
...	...
40228	Drive 10 frequency reference

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