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Distribution Data Collection Module (DDC)

User Manual

APPENDIX A INTERFACE CONTROL DOCUMENTS (ICD)

Rev No.	5	Distribution Data Collection Module (DDC)	Page 1 of 21
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US 6,859,163.
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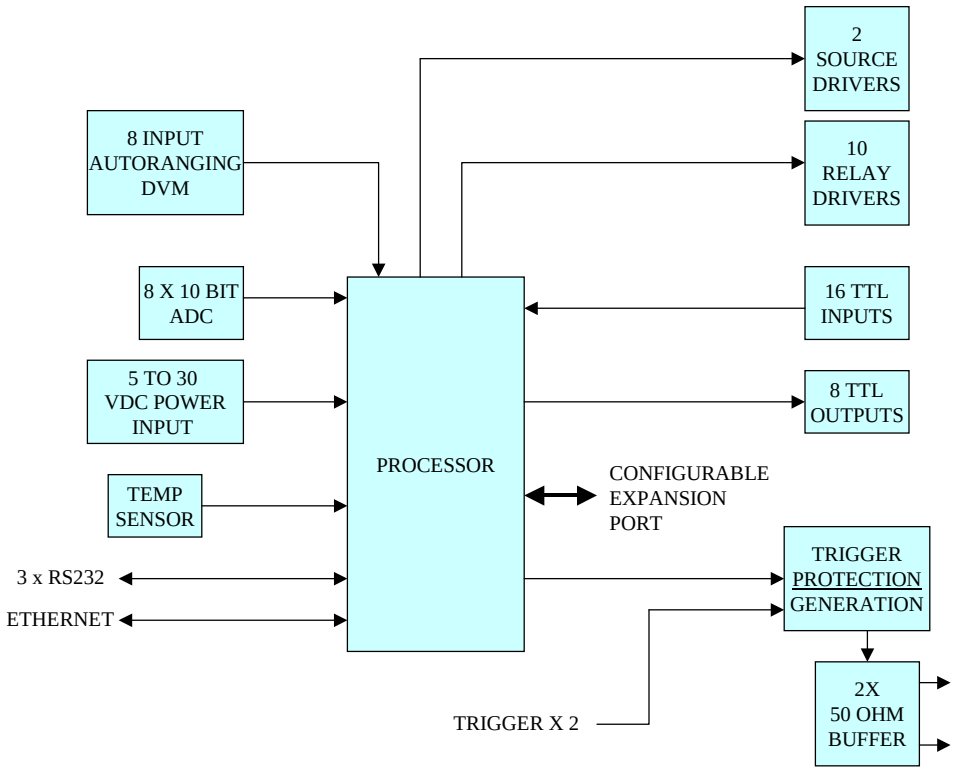
1.0 DDC Module Description

The Distributed Data Collection (DDC) module is an Ethernet, CAN, or serial RS232 controlled device that collects both analog and digital data as well as controls relays. It outputs TTL signals under processor control.

DDC MODULE



DDC BLOCK DIAGRAM

2.0 DDC Hardware Interface

2.1 DDC General Specifications

The DDC module uses a Motorola 5282, 32-Bit processor core module with Ethernet on a Carrier PCA. The Carrier PCA handles all power supply requirements and signal conditioning for the core processor module. A Complex Programmable Logic Device (CPLD) is included on the carrier PCA to handle logic and expansion. Serial ports are buffered on the carrier PCA and routed to the core processor module.

General specifications are listed in Table 1

Specification	Value	Limit
Power supply	+5 to +30 VDC	250ma
Temperature	-20 to +120F	
RS232 Serial ports	3	RS232 Levels
CAN bus port	1	
10 bit ADC channels	8	0-5VDC
DC Voltmeter Inputs	8	+-200 VDC
Discrete Inputs	16	0-30 VDC
TTL outputs	8	40ma
Sink Relay drive outputs	10	500ma
Source +24VDC outputs	2	500ma
Trigger inputs	2	24V peak
Trigger outputs	2	15V or 5V
Programmable Expansion	16	TTL
10/100 Ethernet port	1	10/100

Table 1 - DDC Specifications

2.2 RS232 Ports (J1)

The three DDC RS232 ports are accessible through the 9-pin connector, J1 are listed in Table 2.

Serial Port	Usage
Port 0	Processor console
Port 1	General purpose
Port 0	General purpose

Table 2 – RS232 Serial Ports (J1)

2.2.1 RS232 Pinouts on J1

The RS232 uses a 9 pin D connector but it is used in a NON-STANDARD way: all three serial ports reside on this connector. These communication ports are simple TX/RX serial ports and do not have hardware flow control.

Pin	Function
1	Ground
2	Port 0 RX
3	Port 0 TX
4	Ground
5	Ground
6	Port 1 TX
7	Port 1 RX
8	Port 2 TX
9	Port 2 RX

Table 3 – RS232 Pinout on J1

2.3 Power Input (J2)

2.3.1 Power Pinouts on J2

Pin	Function
1	CAN
2	CAN
3	Ground
4	+24vDC in
5	N/C
6	+24vDC in
7	CAN
8	CAN
9	Ground

Table 4 – Power Pinout

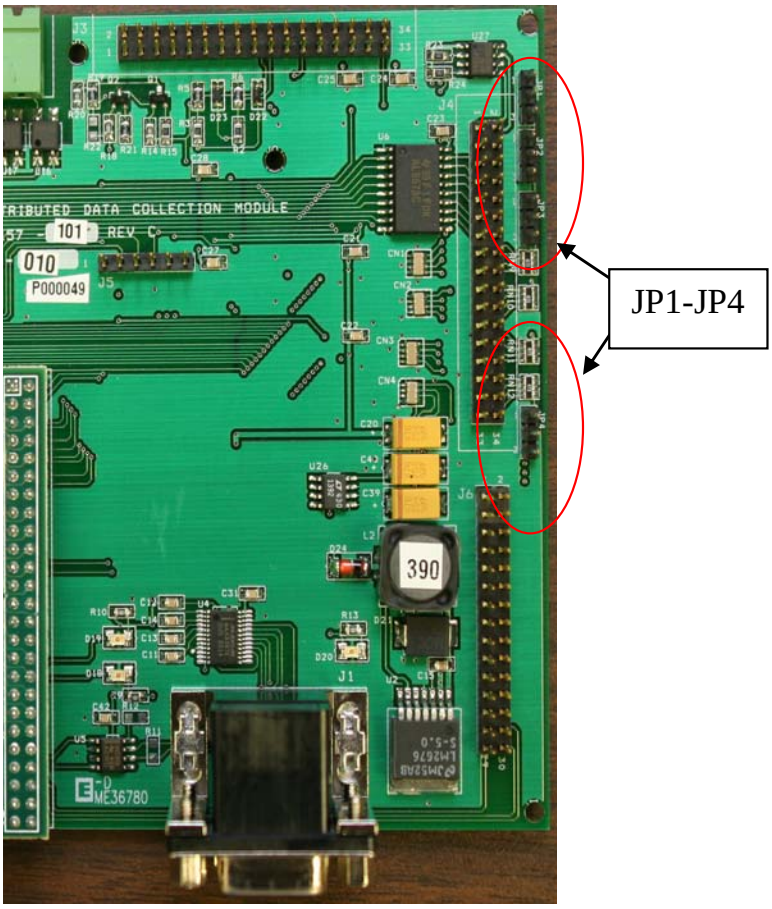
2.4 I/O Ports (J3,J4)

DDC, OPEN

The sixteen wide range discrete DDC inputs are connected to the 37 pin D connector J4 . Each group of four discrete inputs has an associated pull-up selector, JP1 – JP4. By connecting a jumper between pins 1 & 2 a pull-up will be supplied via 4.7K Ohm resistor to +5VDC. Connecting a jumper between pins 2 & 3 will supply a +24 VDC pull-up voltage via the same 4.7K Ohm resistor. Each discrete input is buffered by a 4.7K Ohm resistor and then a Zener diode regulated to 5.1 volts. A .1 mF capacitor is used as a filter on each discrete input. Any one of the 16 discrete inputs can recognize a 1.7 to 30 volt signal without damage to circuits.

JP1 – JP4	Pins	J4 Pin	Pullup
JP1	1&2	8,9,27,28	+5V
JP1	2&3		+24VDC
JP2	1&2	11,12,29,30	+5V
JP2	2&3		+24VDC
JP3	1&2	13,14,32,33	+5V
JP3	2&3		+24VDC
JP4	1&2	16,17,35,36	+5V
JP4	2&3		+24VDC

Table 5 – JP1-JP4 Pinout



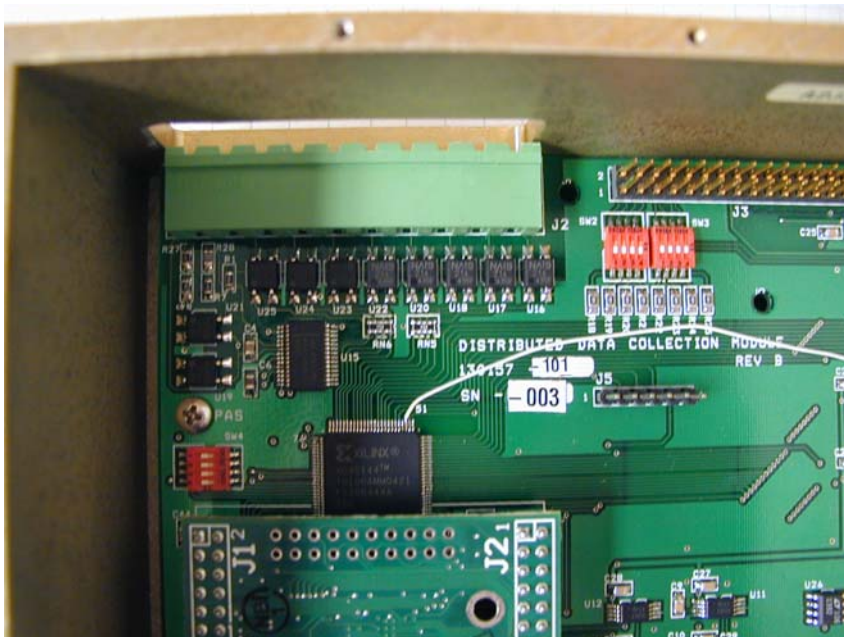
JP1-JP4 LOCATION

The eight buffered TTL outputs are connected to the 37 pin D connector, J4, visible in Figure 4.

The eight analog to digital inputs (ADC) with a resolution of 10 bits are connected to the 37 pin D connector J3, visible in Figure 3. Each input is filtered by a .1 mF capacitor. The reference voltage for the ADC is 5.0 volts. Input range is from 0 to +5 VDC.

The eight Sink Driver outputs are connected to the 37 pin D connector, J3, visible in Figure 3. Each sink driver can sink up to 500ma at up to +24VDC. Each sink driver is equipped with a current protection diode for driving relays or inductive loads.

The DDC auto-ranging DC voltmeter circuit is seen in Figure 5. The auto-ranging DC voltmeter circuit allows the DDC to be connected to a wide range of bi-polar inputs. Voltage inputs can be bi-polar from 0 to 200 volts. The input impedance is 1 Meg Ohm. There are 8 inputs and 2 grounds. Access to the voltmeter inputs are through the J2 10-circuit screw down terminal block connector.



AUTO-RANGING DC VOLTMETER

The DDC module incorporates a digital trigger protection circuit that allows for the input of two separate triggers. Trigger inputs are on 37 pin D connector J3 pins 10 and 11. Each trigger input is 50 Ohm terminated and can take trigger pulses up to 25 V peak with duty up to 50% without damage to circuits. PRF maximums are set in memory and can be changed at any time using the Ethernet or serial interface. The DDC provides trigger generation circuitry for local mode testing of the transmitter. The internal/ external trigger mode is selectable via the Ethernet or serial interface and generates 1007 PRF and 250 PRF.

Trigger outputs are on the same 37pin D connector J3 pins 23 and 33.

2.4.1 I/O Pinouts on J3

I/O Connector J3		
Pin	Input/ Output	Capability
1	AN3	10bit ADC input 0-5VDC
2	AN2	10bit ADC input 0-5VDC
3	AN0	10bit ADC input 0-5VDC
4	AN52	10bit ADC input 0-5VDC
5	Gnd	
6	Gnd	
7	Gnd	
8	Gnd	
9	+5VDC	VCC
10	TrigIn1	0-30V Pulsed Input
11	TrigIn2	0-30V Pulsed Input
12	TrigOut1	15V or 5V Drive output
13	K8	Relay drive @500ma
14	K6	Relay drive @500ma
15	K4	Relay drive @500ma
16	K2	Relay drive @500ma
17	TrigOut2	5V Drive output
18	NC	
19	NC	
20	AN1	10bit ADC input 0-5VDC
21	AN56	10bit ADC input 0-5VDC
22	AN53	10bit ADC input 0-5VDC
23	AN55	10bit ADC input 0-5VDC
24	Gnd	
25	Gnd	
26	Gnd	
27	Gnd	
28	+5VDC	VCC
29	Gnd	
30	Gnd	
31	Gnd	
32	K7	Relay drive @500ma
33	K5	Relay drive @500ma
34	K3	Relay drive @500ma
35	K1	Relay drive @500ma
36	Gnd	
37	NC	

Table 6 – J3

2.4.2 I/O Pinouts on J4

I/O Connector J4		
Pin	Function	Capability
1	+24 Source 1	+24VDC Switched @500ma
2	K9	Relay drive @500ma
3	Dout1	TTL output @40ma
4	Dout3	TTL output @40ma
5	Gnd	
6	Dout6	TTL output @40ma
7	Dout8	TTL output @40ma
8	Din1	0-30VDC discrete input
9	Din3	0-30VDC discrete input
10	Gnd	
11	Din6	0-30VDC discrete input
12	Din8	0-30VDC discrete input
13	Din9	0-30VDC discrete input
14	Din11	0-30VDC discrete input
15	Gnd	
16	Din14	0-30VDC discrete input
17	Din16	0-30VDC discrete input
18	NC	
19	NC	
20	+24V Source 2	+24VDC Switched @500ma
21	K10	Relay drive @500ma
22	Dout2	TTL output @40ma
23	Dout4	TTL output @40ma
24	Dout5	TTL output @40ma
25	Dout7	TTL output @40ma
26	Gnd	
27	Din2	0-30VDC discrete input
28	Din4	0-30VDC discrete input
29	Din5	0-30VDC discrete input
30	Din7	0-30VDC discrete input
31	Gnd	
32	Din10	0-30VDC discrete input
33	Din12	0-30VDC discrete input
34	Din13	0-30VDC discrete input
35	Din15	0-30VDC discrete input
36	Gnd	
37	NC	

Table 7 – J4

2.5 Ethernet (J5)

The Ethernet jack (J5) is located in the rear face of the DDC. This is a standard 10/100-Base-T Ethernet connection jack.

3.0 Software Interface

There are three communication interfaces that software can use to communicate with the DDC. Serial and Ethernet interfaces use identical formats for command and control functions in the DDC.

3.1 Serial Control

RS232 serial control is through the console port, Port 0. This port initializes at a baud rate of 115,200 and uses standard 8-N-1 protocol. See section RS232 Pinouts on J1 for more information on the hardware interface.

3.2 Ethernet Control

The DDC has a 10/100 Ethernet interface which can be used for high-speed communications via socket communications in software.

3.3 Updating the on-board Software

3.3.1 Monitor Program

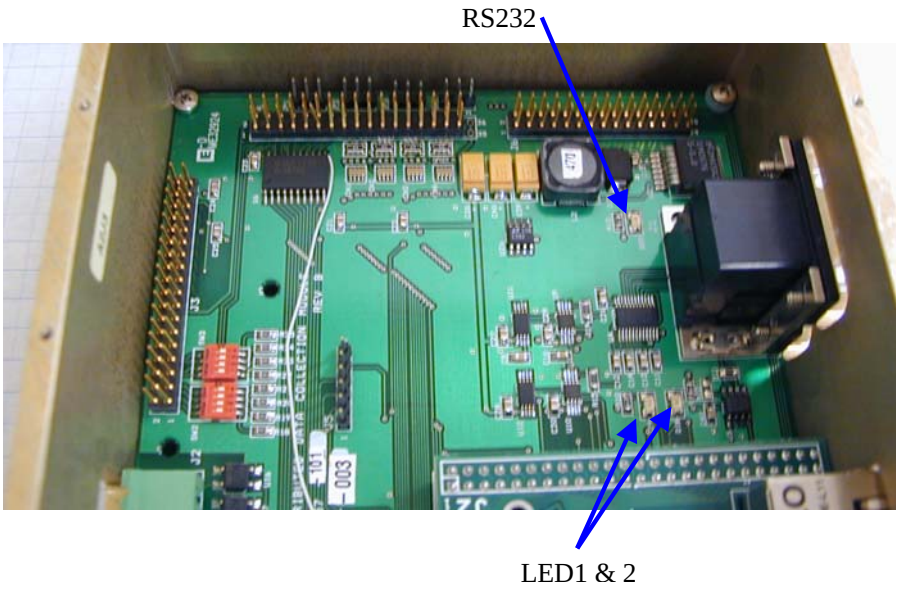
The DDC has an onboard Monitor program. The monitor program loading is detailed in Appendix A.

3.3.2 Main DDC Program

The main DDC program is flash loaded. To update the program, see Appendix A.

4.0 Troubleshooting the DDC

4.1 LED indicators



The DDC module has three LEDs that are used for the following indications:

Indicator	Function
LED 1	Processor running. This LED should blink regularly.
LED 2	Communications link established. This LED should blink regularly.
RS232	RS232 receive level present. This LED should be lit when a good RS232 receive level is detected on any of the three RS232 ports.

Appendix A – Software Loading

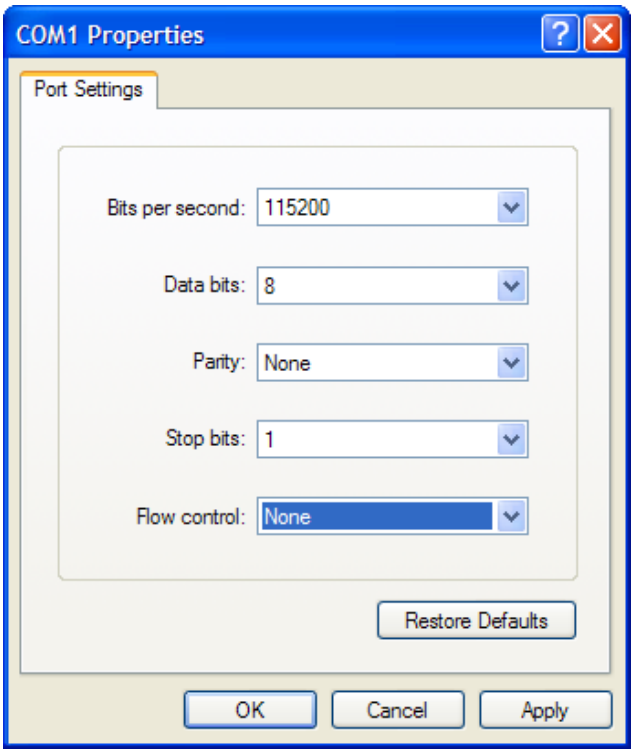
Introduction

The DRCP firmware and boot configuration data is stored in an on-board flash memory. This document is to be used as a guide for configuration and downloading of the application firmware. A processor will need its configuration, modified when it is a new board without an application and initial configuration or when a configuration item such as the network configuration needs to be changed. Configuration and application firmware loading is preformed in the boot monitor console.

Terminal Setup

The firmware and boot configuration data is accessible via the RS-232 console port of each device and can easily be accessed at boot time with a PC serial communications program such as Minicom on Linux or HyperTerminal on Windows.

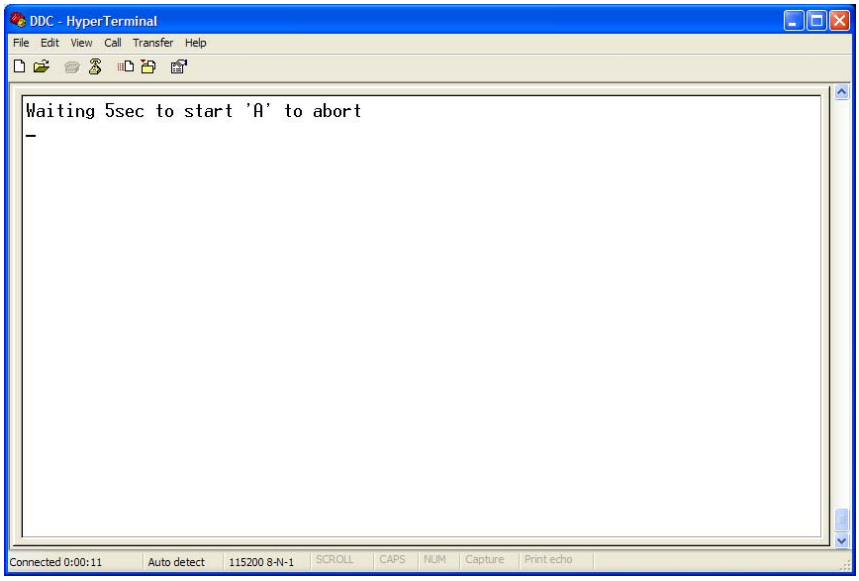
In our examples we will be using HyperTerminal but these procedures should be preformed easily using any terminal communications software. The illustration below shows how the communication port should be configured.



SERIAL PORT CONFIGURATION

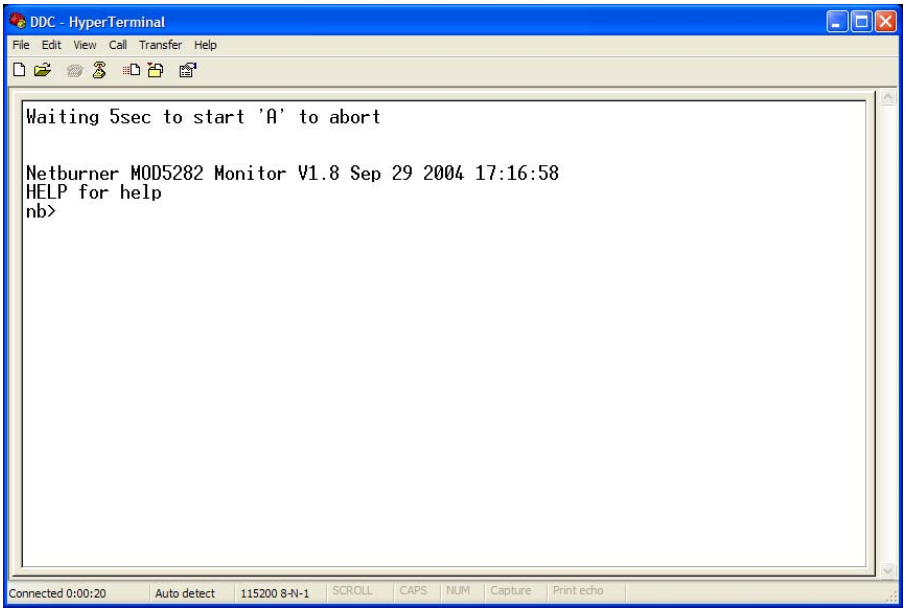
Interrupting the boot process

Once we a have a DRCP module connected to a PC and the terminal software configured properly we should be able to apply power to the module. When the module begins its boot process it outputs a waiting to start message as displayed below .



WAITING TO START

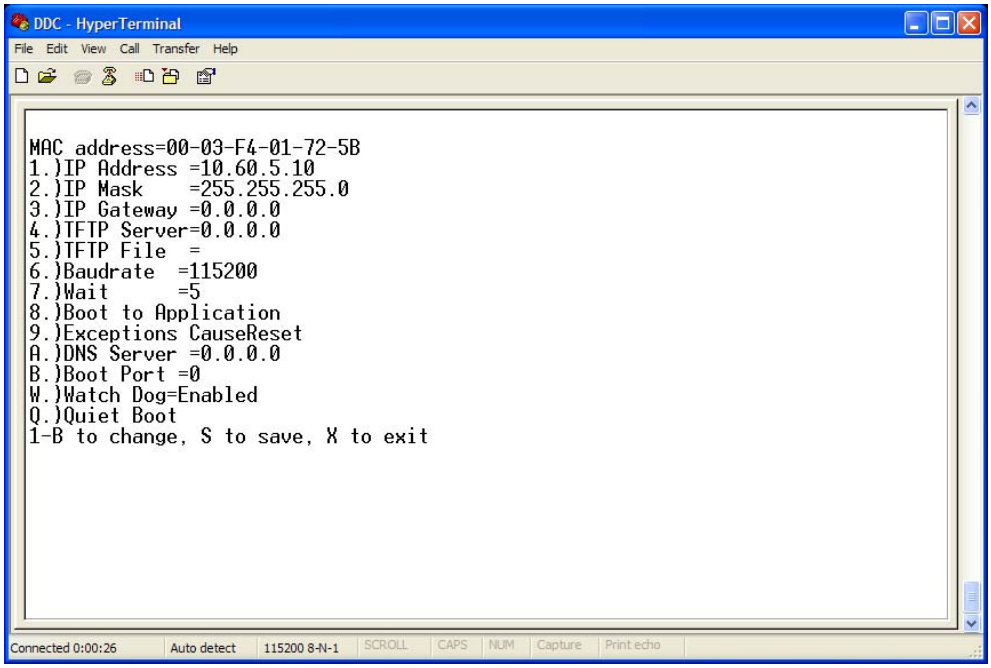
When the waiting to start message appears the *A* character must be sent to the device to interrupt the boot process and enter the configuration screen. Once the boot process has been successfully interrupted, a command prompt will be displayed as shown below. At this point you are ready to change configuration data or download a new application to the module.



MONITOR PROMPT

Operational Parameter Configuration

At the command prompt you may enter the setup menu by typing the command *setup.* The displayed setup menu should look similar to what is displayed below.



SETUP MENU

The menu is operated by simply entering the number or letter preceding the desired menu option. Once all desired changes are made simply entering an *S* will save the options to flash and reboot the processor.

Network Configuration

1) IP ADDRESS

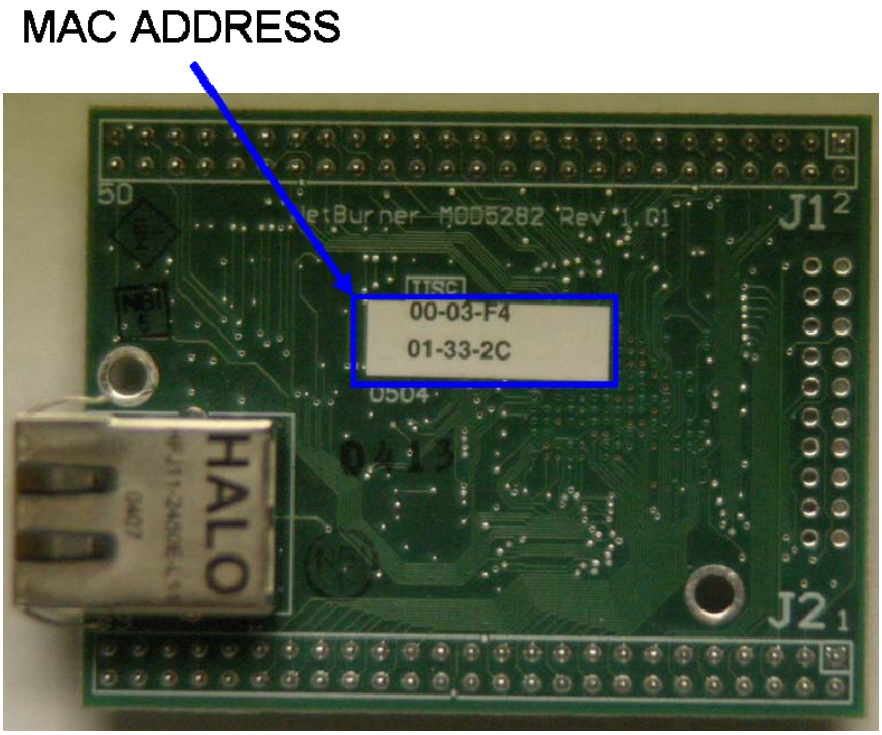
When prompted enter the IP address in the standard IPv4 dotted decimal notation ex: 10.60.5.10.

2) IP MASK

When prompted enter the netmask in the standard IPv4 dotted decimal notation ex: 255.255.255.0

MAC Address

When changing any of the network configuration options you may be asked to enter the 12 digit Ethernet MAC address of the module if the module does not have a valid MAC address stored in flash. Each DRCP processor module has a unique MAC address assigned to it. This address can be found on a label atop the module processor board as illustrated below.



ETHERNET MAC ADDRESS LABEL

In most cases entering of the MAC address will not be required.

Additional Configuration

Besides network configuration it is necessary to configure a few other operating parameters.

Wait

The Wait menu item controls how long the processor waits in seconds before beginning execution of the application stored in flash.

Boot To

The Boot To menu item controls whether the processor boots to the application software or the monitor application. This option should be configured to Boot To Application for normal operation.

Exceptions Cause

The Exceptions Cause menu item controls how the monitor firmware will handle exceptions in the application firmware. This option should be set to Exceptions CauseReset.

Watch Dog

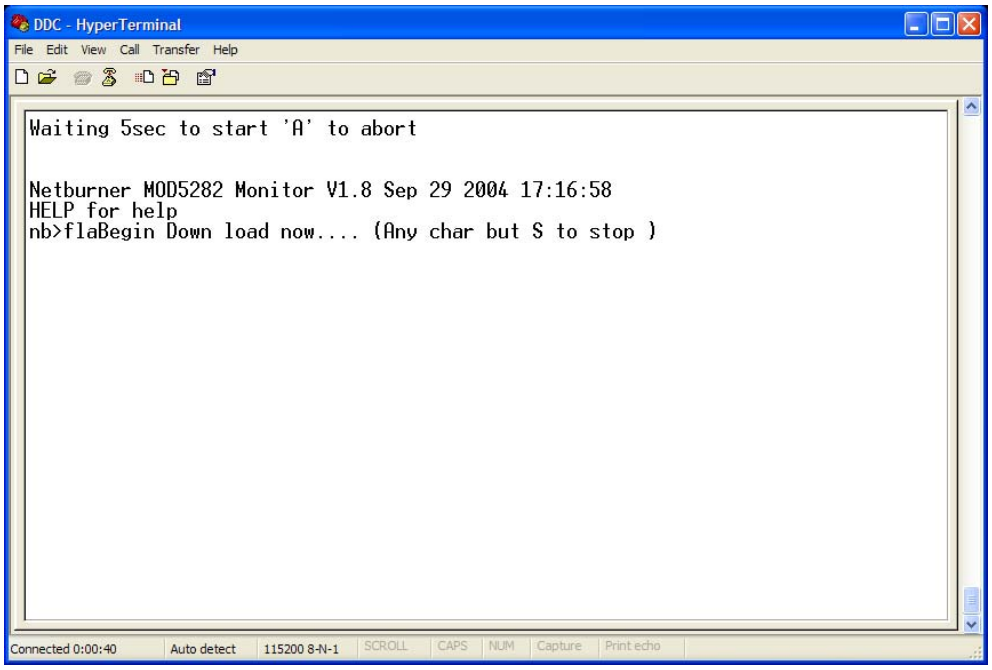
The Watch Dog menu item enables or disables the on chip watchdog timer. This item should be enabled after downloading the application firmware. If this option is enabled and changes need to be made via the boot monitor console, this item should be changed and saved first. Failure to disable the watchdog will result in the repeated resetting of the processor while in the boot monitor console.

Quiet/Loud Boot

The Quiet/Loud Boot menu item toggle configures whether the monitor should display the "Waiting to start message" at boot time. When the menu item reads Quiet Boot the module will display the boot message and selecting the menu item will toggle it to quite mode. When Loud Boot is displayed, the boot message will not appear and selecting the menu item will toggle it to loud mode. This option is used when the NetBurner's COM0 is used to drive an external device such as a LCD panel and if you do not wish to see the boot message on the device.

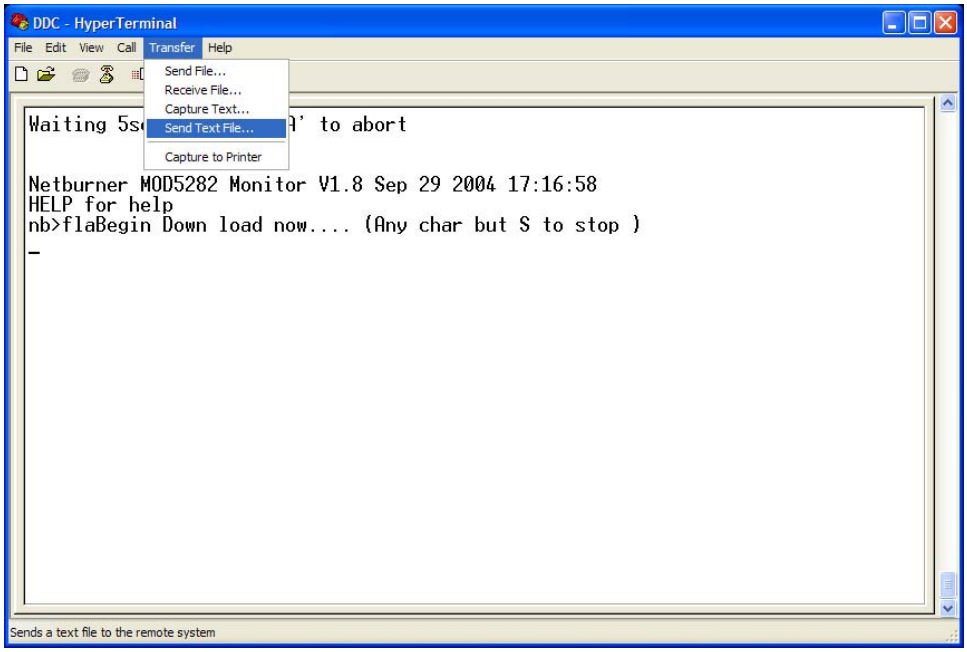
Application Firmware Download

To download the application firmware into flash follow the steps to enter the console monitor prompt above. Once at the console monitor prompt the application software can be downloaded to the module using the *fla* command. This command instructs the module to await transfer of the compressed S record application image. The module will respond with *Begin Down load now…* as seen in the figure below.

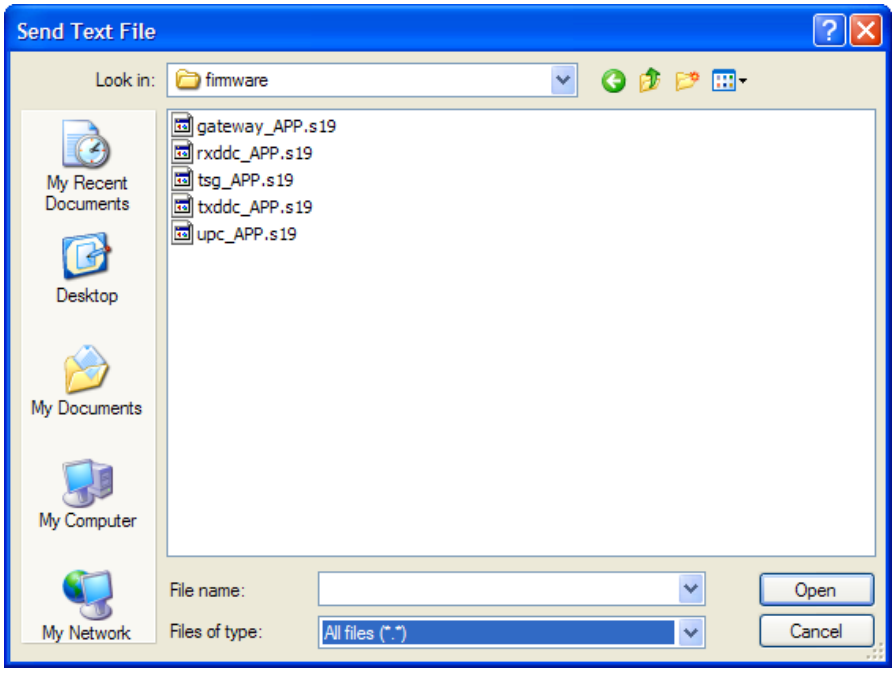


DOWNLOAD COMMAND

The next step is to transfer the application using your terminal software send text file or ASCII file transfer function. The next two figures show how this is done in HyperTerminal.

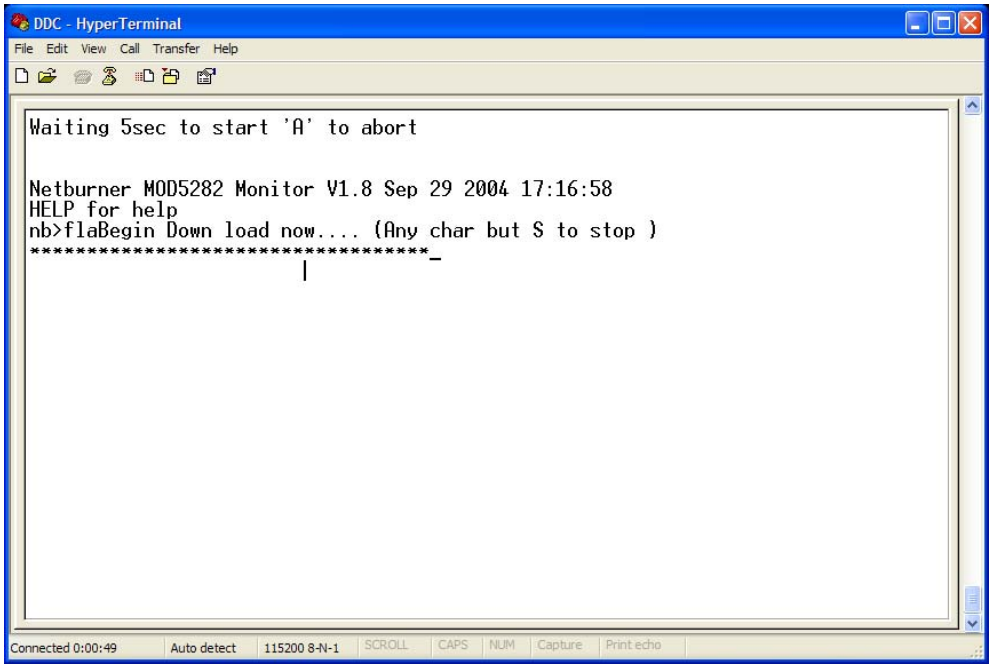


SEND TEXT FILE



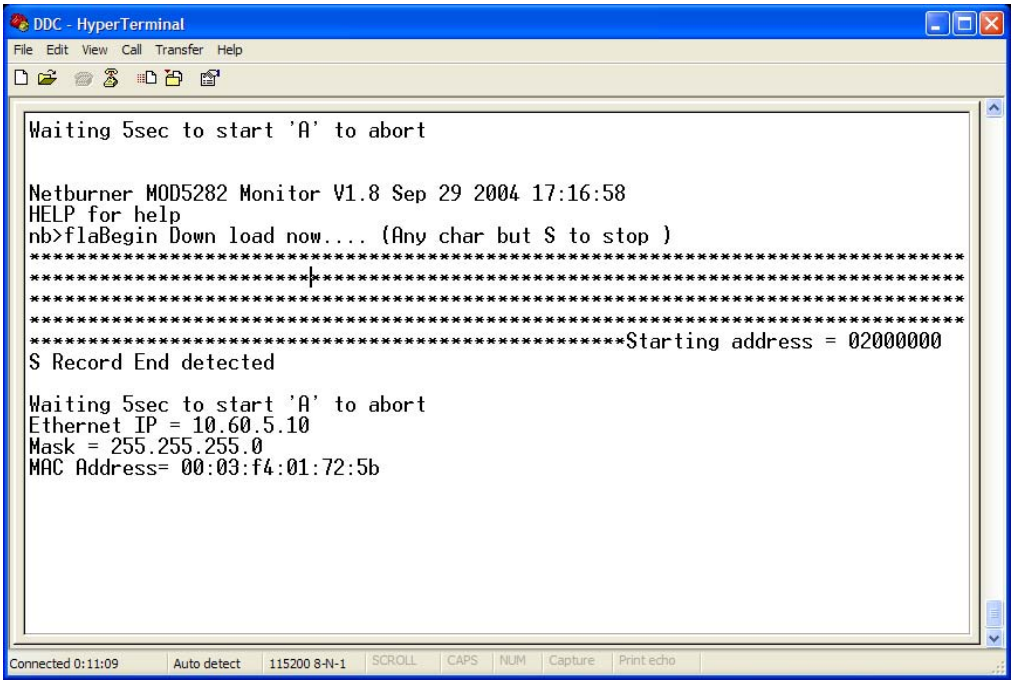
SEND TEXT FILE

While the file download is in progress the module with display a series of * characters indicating that it is receiving the application from the host.



TRANSFER IN PROGRESS

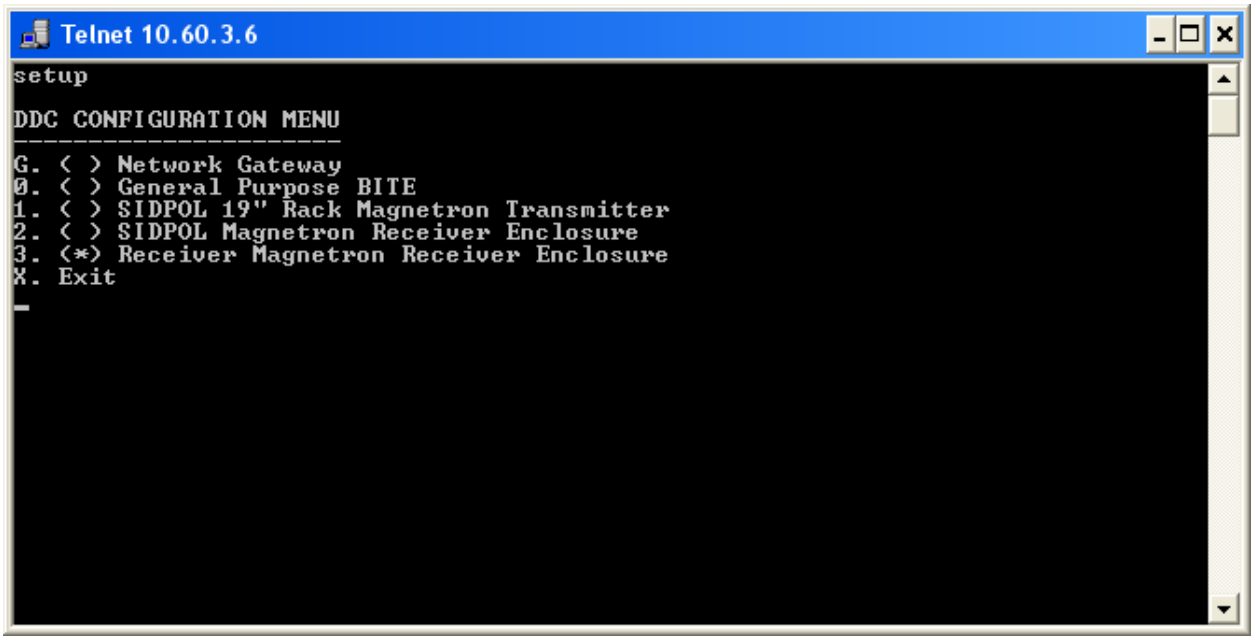
Once the download is complete the module will announce that it has detected the end of the S record, reset itself and run the downloaded application.



DOWNLOAD COMPLETE

Personality Configuration

Once the DDC software has been downloaded to the device it is necessary to configure the DDC's personality by running the setup command from the DDC's command line interface on COM0 or via telnet.



SETUP

After selecting the correct configuration options for your module it is necessary to reset the module by issuing the reset command. The DDC will now reboot and run you selected configuration.