QUCM DF1

Installation and Programming Manual

This Manual describes the QUCM application for interfacing Allen-Bradley DF1 devices to a master of another protocol, including Modbus/TCP.

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Introduction

1

The Niobrara QUCM is a TSX Quantum[®] compatible module that is capable of running multiple applications for performing communication translations between serial protocols. This document covers an application that allows masters of various protocols to communicate with DF1 devices. This setup allows the master to be placed onto an existing Data Highway network via a DF1 to Data Highway bridge.

One application is required to be loaded into the QUCM: qucm_df1_app1.qcm contains the DF1 driver and other serial and Modbus/TCP drivers, and the configuration software. This application must be running for the system to properly perform.

Port 1 of the QUCM is to be connected to the DF1 device. Port 2 may be connected to a Modbus or RNIM master. The QUCM supports many DF1 devices including Helm Instrument Company's Loadgard Serial Interface, SLC-5/0x processors, and the DF1 bridges manufactured by Allen-Bradley. These devices are accessed via the master protocol by selecting the node ID assigned to each slave (0-254).

The QUCM is configured through a website. The website allows the user to change several characteristics of the QUCM, and configure all the devices that will be connected to the DF1 port.

A Modicon two (or more) slot Quantum rack and appropriate Quantum power supply, or the Niobrara QXBP-001 is needed for mounting the QUCM.

Installation

2

Module Installation

1 Mount the QUCM in an available slot in the register rack, or in the QXBP-001. Secure the screw at the bottom of the module.

Software Installation

The application files for the QUCM are included in the QUCM_DF1_SETUP.EXE file. This is a self-extracting zip file that will install the DF1 application to the user's hard drive.. The latest version of QUCM_DF1_SETUP.EXE is located at www.niobrara.com/apps/qucm/df1/QUCM_DF1_SETUP.EXE

The latest version of this document in pdf format is located at:

www.niobrara.com/apps/qucm/df1/df1.pdf

The DF1 communications protocol is available from Allen-Bradley at:

www.ab.com/manuals/cn/17706516.pdf

Serial Connections to the QUCM-OE

Port 2 to Master

If connecting to a Modicon PLC, Port 2 of the QUCM-OE will be set to be RS-232. The Niobrara cable MM2 is ideal for this connection since it includes an RJ45 RS-232 connection for the QUCM-OE and a 9-pin male RS-232 Modicon-style pinout for the PLC. This cable pinout is described in Figure 2-1.



Figure 2-1 QUCM-OE to Modicon RS-232 Port (9-pin) (MM2 Cable)

For an RS-485 connection to SY/MAX devices, Port 2 of the QUCM-OE will be set to be RS-485. The Niobrara cable MM7 is ideal for this connection since it includes an RJ45 RS-485 connection for the QUCM-OE and a 9-pin male RS-485 SY/MAX-style pinout at the other end. This cable pinout is described in Figure 2-2.



Figure 2-2 RS-485 SY/MAX Port (9-pin) (MM7 Cable)

The master must be configured to match the serial settings of the QUCM Port 1. The supported baud rates by both units are 1200, 2400, 9600, and 19200. 19200 baud is the default.





Port 1 to the Personal Computer

A physical connection must be made from the personal computer to the QUCM in order to download the applications. This link may be a serial connection from a COM port on the personal computer to the RS-232 port on the QUCM-OE, or an Ethernet connection between the computer and the QUCM-OE. The Niobrara MM1 cable may be used for the serial connection. This cable is shown in Figure 2-4.





Loading the Applications into the QUCM

The QUCM-OEE or QUCM-OE must use the quemtcpl.fwl or quemtcpl.qcc firmware included in the QUCM_DF1_SETUP.EXE file. This firmware is dated 11OCT2007 or later. There are two ways to upgrade the firmware of the QUCM-OE: QLOAD and FWLOAD.

Using NRDTOOL to set the IP Address

It is recommended to use the Ethernet capabilities of QLOAD to load the firmware, and qucm_df1_app1.qcc into the QUCM. Set up the IP parameters of the module by the following method:

🛃 Niobrara Desktop Tool	
<u>File Windows View</u>	Help
🕫 Open connection	
Modbus TCP Modbus RTU Modbus ASCII Sy/Max	1
Port COM1:	
Baud 9600 Parity Even Stop Bits 1 Data Bits 8	
Max Timeout 5000 Default Slave Address 255	
Register Editor Settings C 0x Registers Slave Address 255	
C 1x Registers Starting Register 1	
Enable Register Editor Software File For the software for the	
Disable single-register writes	
Do not process XML Connect	

Figure 2-5 Setup NRDTOOL

- 1 Move Switch 1 and Switch 2 to Halt.
- 2 Connect the PC to QUCM Port 1 with a MM1 cable.
- 3 In the personal computer, go to Start>All Programs>Niobrara>NrdTool. This will start NRDTool. Set up NRDTool as shown in Figure 2-5. Use the arrow and Page Up/Down keys to move to register 46. The IP parameters are shown in Figure 2-6 for a unit with the IP = 206.223.51.238 subnet Mask = 255.255.255.0, Default Gate = 206.223.51.1, Modbus/TCP port number = 503
- 4 After entering the IP parameters, attempt to ping the module to verify the settings. > ping 206.223.51.238
- 5 Verify a connection to the internal Modbus/TCP server with NRDTool (should connect to the QUCM on port 503 with Destination index 255).

📱 Niobrara Desktop Too	ot			
<u>File Windows View</u>				Help
Ø Modbus TCP 206.22	3.51.238:503:	Register Ea	litor - Editing 255	
Register Editor				
Modbus TCP 206.223 Running Normally	3.51.238:503	- Editir	ng 255	
4× REGISTER HE	K VALUE	SIGNED	BINARY	
	206	206	0000_0000_1100_1110	
48 33	223 1 51	223 51	0000_0000_1101_1111	
49 e	238	238	0000_0000_1110_1110	
50 fi	255	255	0000_0000_1111_1111	
51 fi 52 fi	255	255	0000_0000_1111_1111	
53 1	а 255 Л — Й	2JJ Ø		
54 c	206	206	0000_0000_1100_1110	
55 di	223	223	0000_0000_1101_1111	
56 33 E7	3 51 1	51	0000_0000_0011_0011	
58	5 5	2	0000_0000_0000_0001	
59 () Ó	Ó	0000_0000_0000_0000	
60 2bg	: 700	700	0000_0010_1011_1100	
	U 100	100	0000_0000_0000_0000	
63 1f	503	503	0000_0000_0110_0100	
64 50	9 ŠÕ	80	0000_0000_0101_0000	
65 384	1 900	900	0000_0011_1000_0100	
				✓



QLOAD QUCM Firmware Update

QLOAD is a convenient method for upgrading the firmware of a QUCM, especially if the QUCM already has an IP Address. A direct serial connection to the module is not required, the module does not need to be powered down, and the entire process may be done remotely across the Ethernet.

- 1 Application 1 Switch must be in RUN.
- 2 Start QLOAD.EXE
- 3 Click on the Browse button and select the file quemtcpl.qcc.
- 4 Select the Application 1 Radio Button.
- 5 Verify the following: The Modbus/TCP tab is selected, the IP Address of the QUCM is entered correctly, the TCP Port number is set to 503, and the Modbus Drop is set to 255.
- 6 Press the Start Download button. QLOAD will open a progress window to show the status of the download. Wait approximately 20 seconds for the upgrade to fin-

ish after the download is complete. The unit should be ready to receive the new version of qucm_df1_app1.qcc.

👯 QUCM File Downloader - 10Apr2008 💦 🔲 🗖 🗙
<u>F</u> ile <u>A</u> dvanced <u>C</u> onfigure <u>H</u> elp
Load File ft:\roms\quemtepl.gre
Modbus Serial Modbus TCP Program Info Module Info
206.223.51.238 503 TCP Port
255 Modbus Drop
Application 1 C Application 2
Set Defaults
Query Start Download Cancel

Figure 2-7 QLOAD the QUCM Firmware

FWLOAD QUCM Firmware Update.

If the QUCM has corrupt firmware or completely non-responsive then the old method of using FWLOAD may be required.

Firmware upload is as follows:

- 1 Remove the module from the rack.
- 2 Move the RUN/LOAD switch on the back of the module to LOAD.
- 3 Replace the module in the rack and apply power.
- 4 Only the 3 light should be on. (The Link and RX E-net lights may be on if the E-net port is connected and there is traffic.)
- 5 Connect the PC to QUCM Port 1 with a MM1 cable. Make sure that Port 1 is set to RS232 mode with the slide switch below the port.
- 6 Start the program FWLOAD.EXE
- 7 Select the Browse button and select the file QUCMTCPL.FWL.
- 8 Select the comm port of the PC.
- 9 Press "Start Download".

10 When the download is completed, remove the module from the rack and change the switch back to RUN.

🞕 NR&D Firmware Dov	vnloader 🔳 🗖 🔀									
<u>File A</u> dvanced <u>H</u> elp										
File to load										
c:\niobrara\firmware\qucm	topl.fwl Browse									
Serial Port:	Serial Port: COM1									
Firmware to be written:	QUCMTCPL 110CT2007									
Current firmware revision:	Not queried									
	Query									
Start D	ownload Cancel									

Figure 2-8 FWLOAD the QUCM Firmware

QLOAD QUCM_DF1_APP1

💐 QUCM File Downloader - 10Apr2008	
<u>File A</u> dvanced <u>C</u> onfigure	<u>H</u> elp
Load File pps\QUCM\df1\qucm_df1_app1.qcd	Browse
Modbus Serial Modbus TCP Program Info Modu	ule Info
206.223.51.238 503	TCP Port
255 Modbus Drop	
Application 1 C Application 2	
Se	t Defaults
Query Start Download	Cancel

Figure 2-9 QLOAD of APP1

- 1 Application 1 Switch must be in RUN. Leave Application 2 Switch in HALT.
- 2 Go to Start>All Programs>Niobrara>QUCM>Apps>DF1>QLOAD DF1 Application 1.
- 3 Verify the following: The Modbus/TCP tab is selected, the IP Address of the QUCM is entered correctly, the TCP Port number is set to 503, and the Modbus Drop is set to 255.
- 4 Press the Start Download button. QLOAD will open a progress window to show the status of the download.

After downloading the application, the RN1 light should be on. Open a web browser and point it to the IP Address of the QUCM for configuration.

DF1 to QUCM Port 1

After the software has been installed into the QUCM, Port 1 becomes the DF1 port. The connection for the QUCM to the Allen-Bradley DF1 to DH-485 convertor or the SLC-5/0x is the same as the connection to the PC if the convertor's or PLC's port is set to RS-232(Refer to Figure 2-3). If the convertor's port is set to RS-422, the diagram for that cable is located in figure 2-10.



Figure 2-10 QUCM-OE RS-422 to DF1/DH-485 Convertor RS-422

If connecting the QUCM to the Allen-Bradley DF1 to DH+ bridge, the connection is the MM20. See figure 2-11.



Figure 2-11 QUCM-OE RS-232 to DF1/DH+ Convertor (MM20)

Web Server

Main Page

The Main page displays a summary of the configured DF1 devices. The table will display the Modbus/TCP Destination Index, associated Modbus starting and ending registers, DF1 device address, DF1 file type, and DF1 file number. The page also displays the total number of configured devices.

Figure 3-1 shows an example page with two logical devices configured to talk to the same DF1 address. Entry 1 reads the N9 registers by accessing the Modbus registers 1-250. Entry two has the same Modbus index, but reads the N50 registers by polling registers 500-750. The devices could also be set up as two different Modbus indeces, but both starting at register 1.

At the bottom of the Main page are links to Statistics on this QUCM, and a page for configuring this QUCM. At the left side are the same links, and a link for some help related to this application.

🕲 NR&D's DF1 Server - Mozilla Firefox								
<u>File Edit View His</u> tory <u>B</u> ookmarks <u>T</u> ools <u>H</u> elp								
<u>Home</u>	Home NR&D's QUCM							
<u>Configuration</u>			DF	71 Ser	ver			
<u>Statistics</u>			2 Devices	Configured	(100 max)			
<u>Help</u>	Entry Number	Modbus Address	MB Start Register	MB End Register	DF1 Address	File Type	File Number	
	1	1	1	250	1	Integer(N)	9	
	2	1	500	750	1	Integer(N)	50	
QUCM Clock (NIST DST) 16:08:09 05/07/2008								
Done								3

Figure 3-1 Main Web Page

Configure QUCM

At the bottom of the Main page is a link to configure the QUCM. (See Figure 3-2). The password may need to be entered before access to this page is granted. The default password is "master" and is case sensitive. The password may be altered from the "Change Password" page.

A link is provided for altering the password. The current password must be verified before the new password is edited. The new password must be entered twice for verification. If it has been longer than three minutes since a password protected setting has been altered then the user will be prompted to enter the password.

NOTE: This password protection is not very secure and is only intended to prevent accidental modification to the QUCM configuration. The user should implement other more stringent protection such as firewalls and isolated networks to ensure the safety of the system.

NOTE: Once a password has been accepted by the QUCM, any connection is allowed to modify settings until the timer expires; not just the user who entered the password.

19 NRED's DF1 Server - Nozilla Firefox	
Elle Edit Yew Higtory Bookmarks Icols Help	¢
🐗 + 🕪 - 😴 ③ 🏠 🗋 Hatja (/208.223.51.238).kuniligi	• 🕨 G • Goodbarth 🔍
Element NR&D's QUCM DF1 Server Add Deriver DF1 Server Emert Password Page Total Enter Password Enter Submit Query Peset Submit Query OUCM Clock (NIST DST) 1121 35 05/09/2008 Home	
Done	

Figure 3-2 Enter Password Page

After entering a successful passoword a screen like Figure 3-3 is displayed. Each DF1 device configured is shown with a link to edit the device paramters or remove the device. Links below are given to add a new device, alter the serial port configuration, change the password, change the IP address, change the title, and save the configuration to FLASH.

NRED's DF1 Set	rver - Noz	illa Firefox	4						
Elle Edit Your I	History B	ookmarks Ioo	k Heb						¢
4 · 10 · C	01	Mape	//206.223.51.23	R),pasis			► G+	idden:	6. K
House Add Device Senal Front Charts R 2055 Tables			1	NR&I DF Config	D's Ql I Serv uration	UCM ver Page			
Estations Statistics	Entry	Modbus Addr.	MB Start Register	MB End Register	DFI Address	File Type	File Number	ħ	lodify
Help	1	1	1	250	1	Integer(N)	9	Edit	Remove
	2	1	500	750	1	Integer(N)	50	Edit	Remove
QUCM Clock (NIST DST) 11:23:42 05/09/2008				Entra Senal J Change QU Chang Chang Chang Store Con	dd Device QUCM Clor ort Configu CM TCP/IF e DNS Add nge Pastwor e QUCM T figuration in Home	de ation Address kress rd films FLASH			
Done									

Figure 3-3 Configuration Page

Add Device

The Add Device link is used to add a new DF1 device to the list. A screen like Figure 3-4 is displayed. There is a text field for the Modbus/TCP Destination Index.

There are text fields for the starting and ending registers that the master will use to access the DF1 device. These will help determine the register space to be read from the slave.

There is a text box for the DF1 slave address. Set this to the device address of the DF1 slave..

There is a pull-down for the file type used by the DF1 slave. Valid choices are Status, Bit, Timer, Counter, Control, Integer, Floating Point, Output, Input, String, ASCII, and BCD.

There is a text field for the file number. This, combined with the file type, make up the register space to be read.

NRED's DF1 Server - No.	zilla Firefox			
Elle Edit Yew History B	ookmanks I.ook Help			0
🏘 • 👳 • 🚭 😳 1	1 Http://206.223.51.238/add/		* 🕨 🕢 Geodinash	(4)
House Add Device Senal Pert Clarity R Diss	NR&D's Q DF1 Ser Device Add	UCM ver Page		
Titles Federated	Parameter	Value		
Ears H.A.RI	Modbus Address	0		
Statutics	MB Starting Register Address	D		
Hale	MB Ending Register Address	D		
	DF1 Slave Address	0		
	Fde Type	Status 💌		
	File Number	D		
QUCM Clock (AIST DST) 11:24:37 05/09/2008	Cancel Add Dr Home	Proset		
Done				

Figure 3-4 Add Device Page

Serial Port Configuration

The Serial Port Configuration page allows the altering of the baud rates and parity of QUCM port 1 and 2, the Protocol of Port 2.

Port 1 is fixed as a DF1 Master. Its parity may be set to NONE or EVEN. Its baud rate may be set to 1200, 2400, 9600, or 19200. 19200 is recommended. If connected to a modem or radio, Port 1 may be given a time to delay after RTS has been raised. Also, the timeout values may be set for an ACK and a message timeout on the DF1 side.

Port 2 may be set to Modbus RTU Slave or RNIM Slave. Its parity may be set to EVEN or NONE and its baud rate may be set to 1200, 2400, 4800, 9600, or 19200.



Figure 3-5 Serial Port Page

Save Settings to FLASH

After completion of the configuration, be sure to save the settings to flash. Otherwise the modifications will be lost on the next power cycle of the QUCM. Once the settings are saved to flash, the QUCM's configuration, including its IP settings, will be safe indefinitely.

Statistics Page

At the bottom of the Main page is a link to some statistical information. There is a page about this QUCM, (See Figure 3-6), and a page about the configured devices (See Figure 3-7).

File Edit View His	er - Mozilla Filielox torv Bookmarks Tools Help		
🤙 • 🧼 • 🧭	(3) Attp://206.223.51.238/qucmstats/	-	G - GoodSearch
QUCM Stats Device Stats	QUCM Statist	ics Page	
<u>Help</u>	Item	Value	
	IP Address	206.223.51.238	
	Subnet Mask	255.255.255.0	
	Default Gateway Address	206.223.51.1	
	Internal Modbus/TCP Server TCP Port	503	
	Module MAC Address	00-20-BD-08-16-84	
	Module Serial Number	530052	
	Boot Firmware Revision	QUCM BOOT 19NOV98	
	Downloaded Firmware Revision	QUCMTCPL 110CT2007	
	Application 1 Revision	07MAY2008	
	Modbus/TCP Connections Active	9	
	Modbus/TCP Connections Since <u>Reset</u>	35	
	Web Connections Since <u>Reset</u>	1099592942	
	Last App1 Halt Error Code	x0000	
	Last App1 Halt Line Number	0	
	Port 1 Switches	Run, RS-232	
	Port 2 Switches	Halt, RS-485	
	Most Recent 4x Register 1 Write Value	0	
	Daylight Savings Time Value	50	
	Daylight Savings Time Offset	1	
	Daylight Savings Time Flag	0	~
Done			3

Figure 3-6 QUCM Statistics Web Page

NRED'S DF1 Se	rver - Nozi	lla Firefox	6									
e Est Yen	Higtory Box	okmarks Io	ok (960)	238/devicesta	ats,i					• 600	harth	
onte orficeration alistics 2028 Data Service Stata				N D	R&I DF	D's QI I Serv	UCM ver :s Page	[,				
2	Entry Number	Modbus Address	MB Start Register	MB End Register	DF1 Address	File Type	File Number	TX Count	Good Rephies	Time- outs	CTS Fail	Retry Count
	1	1	1	250	1	Integer(N)	9	80	0	80	80	0
	2	1	500	750	1	Integer(N)	50	0	0	0	0	0
DCM Ctock IST DST) 30.20 /09/2008					Ŀ	<u>Home</u>						
												11

Figure 3-7 Device Statistics Web Page

Examples

4

Example 1

Figure 4-1 displays an example Modbus/TCP to DF1 bridge from a Modicon Quantum PLC. The Quantum PLC polls the DF1 device across Modbus/TCP, and the QUCM converts the message to DF1.

The Quantum sends a query using its I/O Scanner with an index of 1 and a register address of 1. The QUCM has been programmed so that index 1 and starting register 1 will be sent to DF1 address 1, polling N9 registers.

The QUCM will receive the Modbus/TCP message device 1, register 1, translate the message to DF1, and route it out port 1 to Node ID 1. When the DF1 device responds to the query, the QUCM will receive the response at port 1, convert the message to Modbus/TCP, and route back out the Ethernet port.



Figure 4-1 Modbus/TCP Example

Example 2

This example describes the use of the DF1 application to interface a Quantum PLC to a Helm Loadgard Serial Interface. The configuration and connection to the Quantum is the same as in Example 1. Figure 4-3 shows the connection from the QUCM to the Loadgard. For this example, Port 1 of the QUCM must be set to RS-422.



Figure 4-2 QUCM-OE RS-422 to Helm Loadgard Serial Interface

Troubleshooting

5

Module Lights

The QUCM-OEE has several lights that indicate the status of the module. Table 5-1 shows the meanings of these lights.

Light	Meaning		
Fault	The module has a catastrophic fault Call the factory.		
Active	This light will be on if the module is in a traffic-copped slot in a Quantum PLC system and the PLC is in RUN.		
Ready	This light should always be on (as long as it isn't in firmware load).		
Run	This light will be on if the module is in a traffic-copped slot in a Quantum PLC system and the PLC is in RUN.		
Col	Comes on when an Ethernet collision occurs.		
Lnk	Is on when LINK is established on the 10BaseT port.		
TXE	Comes on when the module is transmitting on the Ethernet port.		
RXE	Comes on when the module is receiving on the Ethernet port.		
RN1	This light should be on to indicate app1 is running.		
TX1	Comes on when the module is transmitting on serial port 1.		
RX2	Comes on when the module is receiving on serial port 1.		
RN2	This light should not come on since there is no app2 loaded.		
TX1	Comes on when the module is transmitting on serial port 1.		
RX2	Comes on when the module is receiving on serial port 1.		

User Lights

The QUCM-OE has 10 application driven lights numbered 1-10. The meaning of these lights while the APP1 program is running is shown in Table 5-2.

Light	Meaning
1	Lights when a DF1 read is sent
2	Lights when a DF1 write is sent
3	Lights when Modbus/TCP socket 1 is open.
4	Lights when Modbus/TCP socket 2 is open.
5	Lights when Modbus/TCP socket 3 is open.
6	Lights when Modbus/TCP socket 4 is open.
7	Lights when Modbus/TCP socket 5 is open.
8	Not Used
9	Lights when a telnet session is open.
10	Lights when a web socket is open.

Table 5-2 User Light Definitions