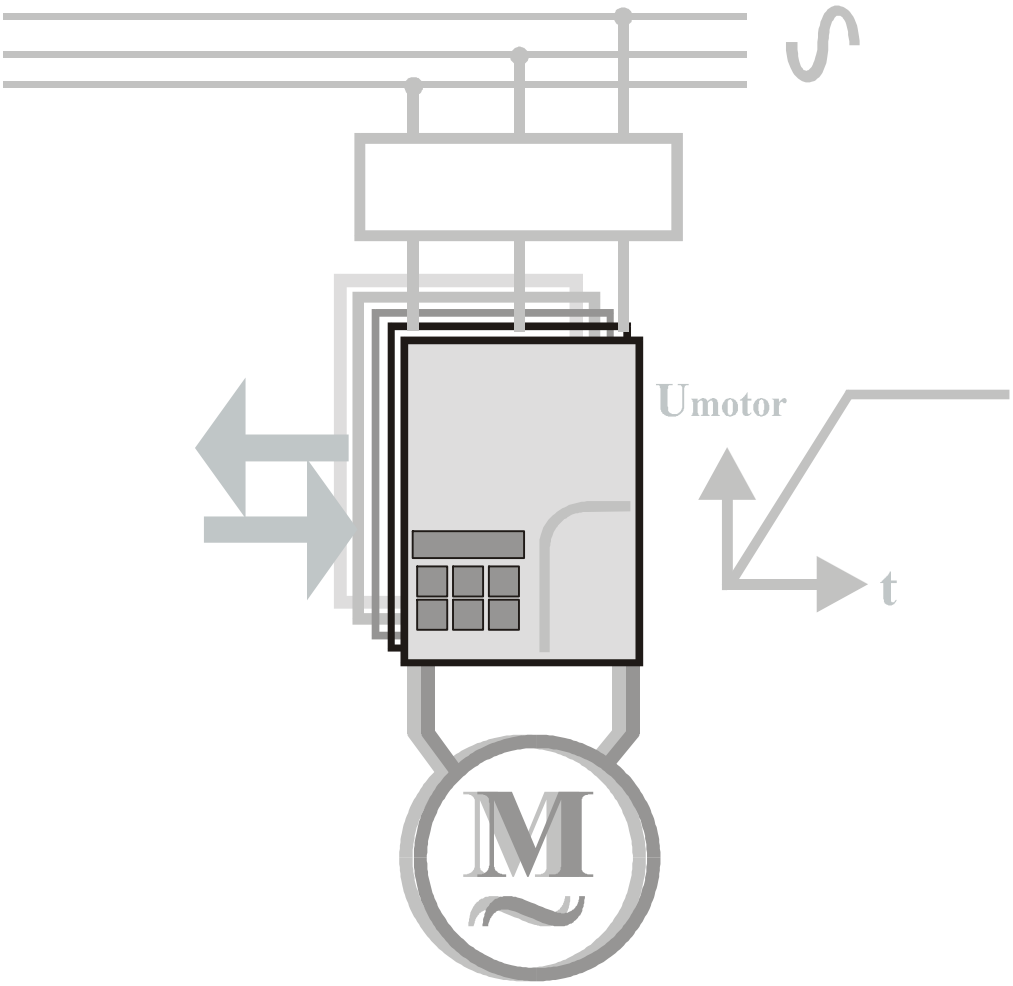
QFE

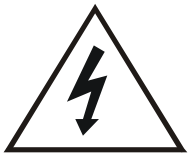
Soft Start Motor Controller



Technical Data for the QFE and QFEplus

Modbus Protocol Manual

FD5100 issue02_F



WARNING

The owner, installer and user is responsible for the correct installation and use of the QFE and must ensure that only qualified personnel install the QFE and that the installation, operation and maintenance of the unit complies with the relevant Codes of Practice, Regulations and Statutory Requirements. The Manufacturer or his agent do not assume any liability, expressed or implied, for any consequence resulting from inappropriate, negligent or incorrect installation, application, use or adjustment of the product or circuit design, or from the mismatch of the unit to a motor. To prevent an electrical shock hazard the QFE must be connected to a safety earth. The unit is not designed for use in hazardous areas. Use in such an area may invalidate the hazardous area certification.

Copyright Information

6 The Modbus Protocol

6.1 Overview

The QFE has built in serial communications this has been changed from Version 55 onwards to be a compatible subset of the widely recognised Modbus RTU protocol (slave).

The serial communications is accessible from the keypad connector or with an additional interface card (RS485 or RS232) the QFE may be connected to a PC or suitable PLC network.

6.2 Quick Start

Work should only be carried out on the QFE with all electrical power disconnected

1) Default Communication settings
   a) 9600 baud, 8 databits, 1 stop bit, no parity
   b) network station number = 1

2) Before Connecting a Comms interface use the standard keypad to make any changes for your bus system.
   a) Set parameter 1 to the required network station number now unless station 1 is spare on the network.
   b) Make any changes to parameter 125 Baud rate
      0 = 9600
      1 = 15625
   c) Make any changes to Parameter 121, $20 (Coil 974).
      0 = 1 Stop bit
      1 = 2 Stop bits
   d) Store changes to eerom (save ram).

3) The QFE standard keypad **MUST BE DISCONNECTED** while any optional communication interface is fitted unless the interface provides a suitable connector. See the relevant application notes for connection of the various interface cards.

4) Details of registers, Flags are available in FD8416 series of documents.

5) Register and coil address start at zero; register zero is addressed as zero, **register one is addressed as one** …

Allowed address ranges are Register numbers are 0…127, 1000…1127, Coils (flags) 0…1024.

6) Registers are mapped one to one, that is register one on the keypad is register one on the Modbus.

7) Flags on the Modbus are read as holding registers i.e. read register 9 to read status2 flags. For writing flags are mapped one to one so for example the the Kick Start Flag bit 0 of User Flags 1 (P51) is bit no 51 * 8 + 0 = Flag 408.

6.3 Specification

1. Refer to Modicon Modbus Protocol Reference Guide PI-MBUS-300 for full protocol specification.
2. Baud rate is either 9600 (default) or 15625.
3. 8 data bits, no parity, 1 stop (default) or 8 data bits, no parity, two stop bits.
4. Modbus timeout is 3.5 character times, the in message timeout is also 3.5 character times unlike the standard which is 1.5 character times. Further it is also possible that the QFE will be appreciably delayed in responding to a telegram if it is checking a fault condition.
5. Broadcast is not supported.
6. QFE parameters retain their normal numbers (0-127).
7. Flag parameters are bit positions starting at parameter 0 bit 0
8. Register numbers are 0…127
9. Coils (flags) 0…1024
10. Offline eerom Registers are 1000…1127
11. Supports

    Function 03 read holding registers up to 4 words (8 parameters) in number.

    Function 05 preset single coil.

    Function 06 preset single register (byte).

    Function 07 exception status.

    Function 16 preset multiple registers upto 3 words (6 parameters).

    Error 01 illegal function (write to read only parameter)

    Error 02 illegal data address (bad parameter number)

    Error 03 illegal data (trying to read or write too much data)

    Error 06 slave busy

    Error 07 negative acknowledge

6.4 Function 03 - Read holding registers

This function is used to read a group of up to eight parameters from the QFE.

The allowable address range for this function is 0-127 for working parameters and 1000 – 1127 for offline eerom parameters.

QFE parameters are bytes, Modbus reads the values from the slave as words so to speed up communications two QFE parameter bytes are packed into each Modbus word. The lowest parameter is in the data Hi of the word and the next parameter is in the data Lo. This also means that even when the read request is for one register two QFE parameters are read, up to 4 contiguous words (8 parameters) may be read with one query.

Modbus function 3 transaction table

Query	
Field	Byte
Slave Address	**01**
Function	**03**
Start Address Hi	**00**
Start Address Lo	**01**
No of registers Hi	**00**
No of registers Lo	**01**
CRC Lo	**??**
CRC Hi	**??**

Response	
Field	Byte
Slave Address	**01**
Function	**03**
Byte Count	**02**
Data Hi	**01**
Data Lo	**2C**
CRC Lo	**??**
CRC Hi	**??**

6.5 Function 05 - Preset Single Coil

This function is used to set or clear a single Flag, a flag is a bit within parameters 0-127. Only flags in parameters known internally to be flag registers and marked for read write may be preset with this function. Therefore the range of available flags is 0-1024.

The normal response for correct operation is an echo of the data.

Modbus function 5 transaction table

Query	
Field	Byte
Slave Address	**01**
Function	**05**
Coil Address Hi	**01**
Coil Address Lo	**98**
Force Data Hi	**FF**
Force Data Lo	**00**
CRC Lo	**??**
CRC Hi	**??**

Response	
Field	Byte
Slave Address	**01**
Function	**05**
Coil Address Hi	**01**
Coil Address Lo	**98**
Force Data Hi	**FF**
Force Data Lo	**00**
CRC Lo	**??**
CRC Hi	**??**

6.6 Function 06 - Preset Single Register

This function is used to set the value of a single parameter. **It differs from the modbus protocol** in that only the data Lo byte of the query is written to the parameter address. The data Hi byte is ignored.

The normal response for correct operation is an echo of the data.

Modbus function 6 transaction table

Query	
Field	Byte
Slave Address	**01**
Function	**06**
Address Hi	**00**
Address Lo	**0C**
Force Data Hi	**00**
Force Data Lo	**09**
CRC Lo	**??**
CRC Hi	**??**

Response	
Field	Byte
Slave Address	**01**
Function	**06**
Address Hi	**00**
Address Lo	**0C**
Force Data Hi	**00**
Force Data Lo	**09**
CRC Lo	**??**
CRC Hi	**??**

6.7 Function 07 - Exception status

This functions format is as per the modbus standard but the bits in the value returned have different meanings shown below. This is the quickest of the modbus functions and should be used in the context of the QFE to check if a station is present or check if it is busy

Modbus function 7 transaction table

Query	
Field	Byte
Slave Address	**01**
Function	**07**
CRC Lo	**41**
CRC Hi	**E2**

Response	
Field	Byte
Slave Address	**01**
Function	**07**
Exception Data	**00**
CRC Lo	**??**
CRC Hi	**??**

6.7 continued

Returned Exception Data

Bit	Meaning
0	Enabled
1	Stopped
2	Starting
3	Current Limiting
4	TOR (Start Complete)
5	Cooling
6	Alarm
7	Offline Command Failed

6.8 Function 16 - Preset Multiple Registers

This function is used to set the values of multiple parameters. **It differs from the modbus protocol** in that since all parameters are bytes they are packed into the 16 bit register space lowest parameter number to hi byte then the next parameter in the low byte and so on up to 3 contiguous words (6 parameters) may be preset with one query.

Modbus function 16 transaction table

Query	
Field	Byte
Slave Address	**01**
Function	**10**
Address Hi	**00**
Address Lo	**0A**
No. of Regs Hi	**00**
No. of Regs Lo	**02**
Byte Count	**04**
Data Hi	**??**
Data Lo	**??**
Data Hi	**??**
Data Lo	**??**
CRC Lo	**??**
CRC Hi	**??**

Response	
Field	Byte
Slave Address	**01**
Function	**10**
Address Hi	**00**
Address Lo	**0A**
No. of Regs Hi	**00**
No. of Regs Lo	**02**
CRC Lo	**??**
CRC Hi	**??**

6.9 Returned Errors

If there is any communication error in the query the QFE does not reply.

If the network communication is Ok but for some reason the QFE cannot correctly execute the query then it will return an error reply. In an error reply the function byte is returned OR'ed with $80 and the following byte contains the error number. The table below shows the query/reply that would be expected if the slave was busy

Modbus function 7 transaction table showing error response

Query	
Field	Byte
Slave Address	**01**
Function	**07**
CRC Lo	**41**
CRC Hi	**E2**

Response	
Field	Byte
Slave Address	**01**
Function	**07**
Exception Data	**00**
CRC Lo	**??**
CRC Hi	**??**

Number	**Modbus**	**Meaning**
1	Illegal Function	Writing
2	Illegal Data Address	Out of allowed parameter range
3	Illegal Data	Too many data bytes in query
6	Slave Busy	Slave is performing a long command

6.10 QFE Commands

The QFE Modbus series software has a new mechanism for carrying out common functions or offline ones which take a long time and require the QFE to be off and disabled. Commands are now carried out by writing various values to a Command Register (parameter 124) .

Once a value has been written to This special register further Modbus queries will receive an error “slave busy” until the command execution is completed. If an error occurred during the execution of the command (say the unit was not disabled before execution) then the Offline Command failed flag will be set. If function 7 has been used to poll the QFE then once the busy period is over this flag is available in the returned status byte position $80.

Parameter 124 Command Codes

Number	Command	Active	Meaning
1	Disable Starter	Always	Stop the QFE responding to start commands, remote or local. If running the QFE will stop immediately. The status of any start signal is not changed.
2	Enable Starter	Always	The QFE will respond to new or existing start commands
3	Bus Starting	Always	The QFE responds to start requests from the keypad/Bus
4	Remote Starting	Always	The QFE responds to start requests from the hardware input
5	Reset Starter	Always	The QFE is forced to a cold start
6	Reset Trip	Always	Resets the QFE to stopped and ready state
7	Bus Start	When Enabled	If Starting = bus & unit is enabled, QFE will start
8	Bus Stop	When Enabled	QFE will always stop
9	Factory Default	When Disabled	The working ram is loaded with factory default values, this may take up to 5 seconds
10	Power On Default	When Disabled	The working ram is loaded with the permanent store values
11	Save ram	When Disabled	The working ram is saved to the permanent store for future use, this may take up to 5 seconds