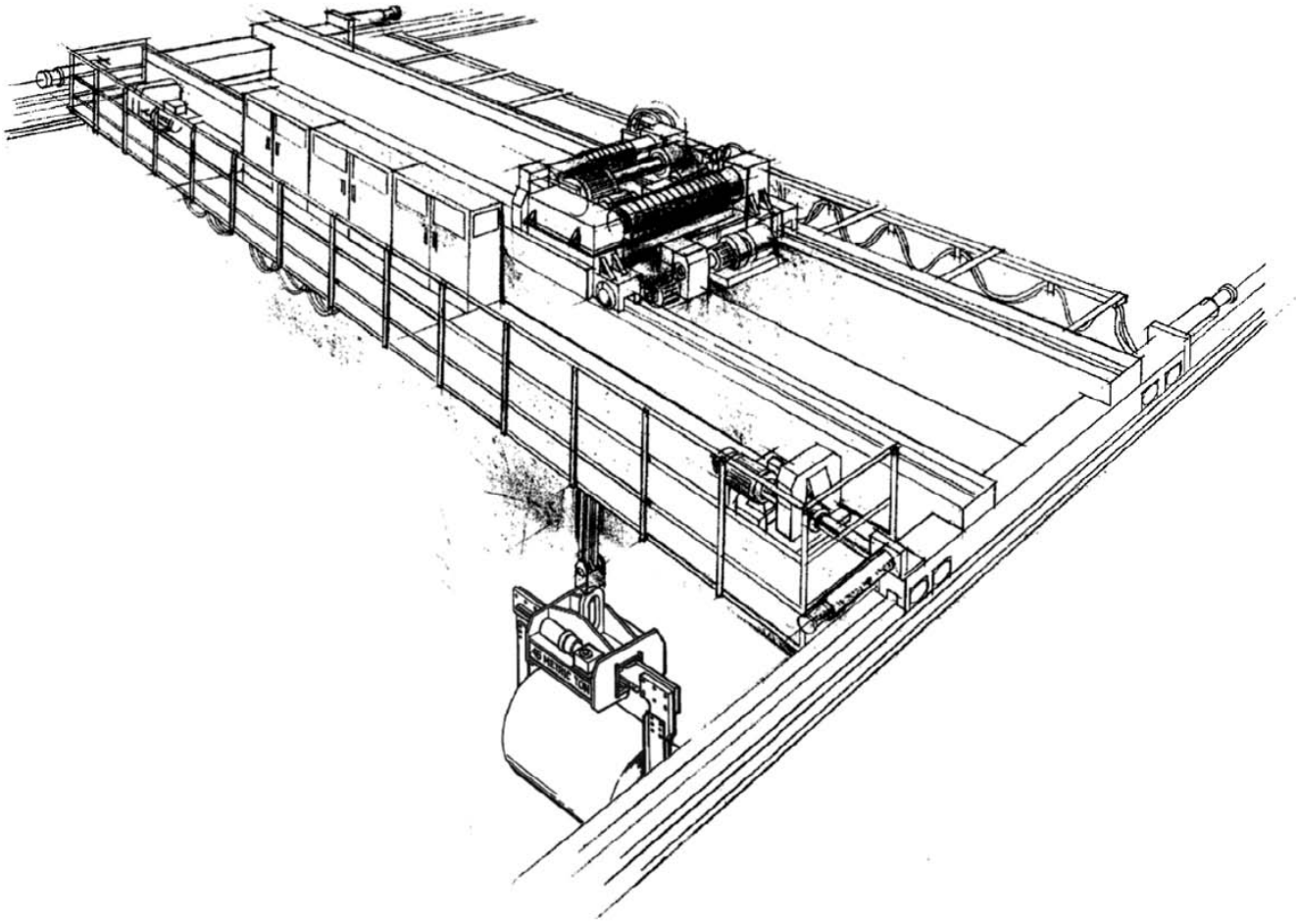

IMPULSE ● G+/VG+ SERIES 3
MODBUS-RTU

Drive Communication Instruction Manual

MAGNETEK
MATERIAL HANDLING

Electromotive

Part Number: 144-42143

February 2006

Technical References

Refer to the following Magnetek Electromotive publications for further information about IMPULSE Series 3 Drives:

- IMPULSE G+ Series 3 Drive Instruction Manual
  Part Number 140-10258

- IMPULSE VG+ Series 3 Drive Instruction Manual
  Part Number 140-10257

Refer to the following Modicon publication for technical information on Modbus RTU protocol:

- Modicon Modbus Protocol Reference Guide
  Modbus Protocol
  http://www.modicon.com/techpubs/toc7.html

Magnetek Electromotive Support

Magnetek Electromotive offers support services for Drive installation and programming. Magnetek Electromotive will not be held responsible for supporting Master Devices that were not provided by Magnetek Electromotive.

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Chapter 1
IMPULSE G+/VG+ Series 3 Drive and Serial Communication

- Introduction to IMPULSE Series 3 Drive Modbus RTU Communication
- Standard RS-485 Serial Communication

Introduction to IMPULSE Series 3 Drive Modbus RTU Communication

This manual describes the set-up and protocol for Modbus Communication. The IMPULSE Series 3 drive offers RS-485 serial communication as a standard.

The Modbus RTU protocol requires that the controller communicates using a master-slave technique, in which only one device (the master) can initiate transactions. The other devices (the slaves) respond by supplying the requested data to the master, or by taking the action requested. The IMPULSE Series 3 drive must act in the slave mode.

A complete understanding of drive programming and operation is required before attempting serial communication operation. A full discussion of programming and operation is covered in the Impulse G+/VG+ Series 3 drive instruction manuals.

IMPULSE Series 3 Drive / Modbus RTU Specifications

The data that may be sent or received from the drive consists of:

- -Run Command
- -Frequency Reference
- -Fault Contents
- -Drive Status
- -Drive Parameter Settings

The following table illustrates whether the serial communication specifications are fixed or user selectable. If the specification is fixed, the fixed value is shown in the last column. If the specification is selectable, the range of allowed values is shown in the last column.

Communication Specification	Fixed or Selectable	Range
Baud Rate	Selectable	2400, 4800 9600 or 19200 bps
Data Bit	Fixed	8
Parity	Selectable	None, Even, or Odd
Stop Bit	Fixed	1
Nodes	Selectable for RS-485	maximum of 31 nodes

Standard RS-485 Serial Communication

The Impulse Series 3 drive offers RS-485 serial communications as a standard feature of the drive. RS-485 allows multi-drop (multiple devices) communication, over a maximum transmission distance of 4,000 feet. The master performs serial communication with one slave at a time. A slave receives a command from the master, performs the specified function, and sends a response back to the master.

Chapter 2
Wiring

- Connection of Multiple IMPULSE Series 3 Drives
- Wiring Instructions
- *Figure 2-1. Control Board*
- *Figure 2-2. Shielded Wire Termination*
- *Table 2-1. Functions of Terminals*
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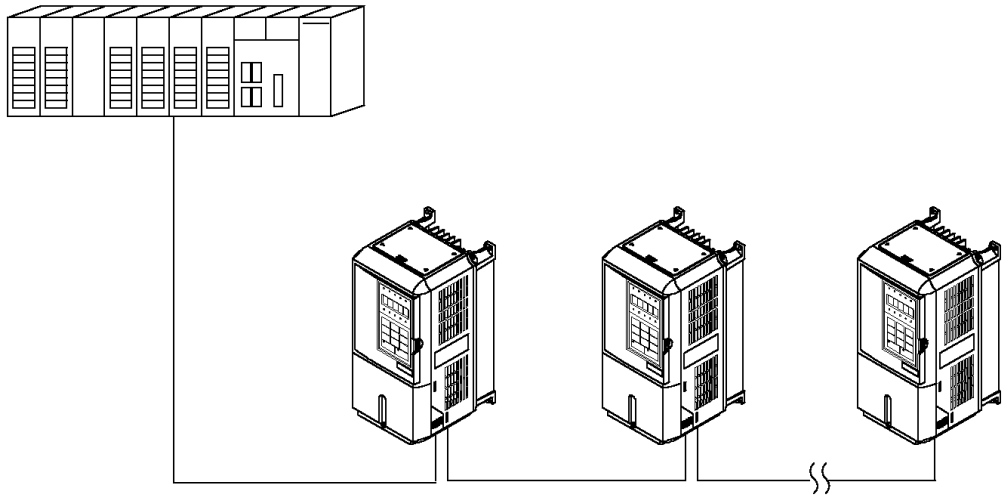
- *Figure 2-3. SI Dip Switch*

Connection of Multiple IMPULSE Series 3 Drives

With the RS-485/RS-422 multiple drives may be connected together for a multiple drive communication system. The following diagram illustrates the connection between a master and multiple slaves.



Example of Connections between Master and Drive

1. Locate terminals: R+, R-, S+, S- on the control board, as shown below.

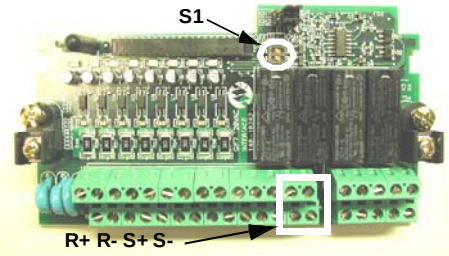


Figure 2-1. Control Board

2. A twisted shielded wire should be used for connection to these terminals. The shielded Wire should be separated and connected per the drawing below to eliminate interference due to noise.

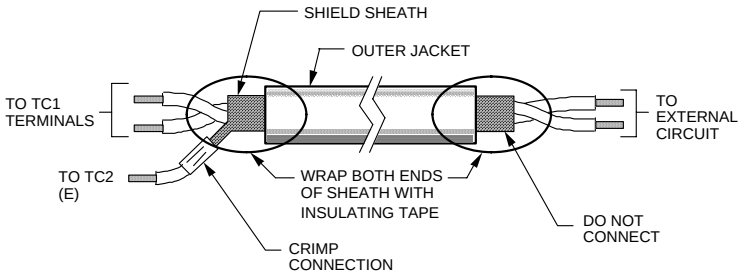


Figure 2-2. Shielded Wire Termination

3. The function of the terminals is described in the table below.

Table 2-1. Functions of Terminals

Classification	Terminal	Signal Function	Description	Signal Level
RS-485/422	R+	Modbus communication input	For 2-wire RS-485, jumper R+ and S+ and jumper R- and S-	Differential input, PHC isolation
	R-			
	S+	Modbus communication output		Differential output, PHC isolation
	S-			
	IG	Signal Common		

4. It is important that an appropriate wire size is selected. The suggested wire size is 16/14 (AWG/KCMIL).

Note: Avoid sources of electric interference capable of inducing noise into the cable. Communication and signal wiring should be kept separate from power wiring. If communication or signal wiring must cross power wiring, it must cross at a right angle.

Terminating Resistor

Dip Switch S1 is located on the control board. (See Figure 2-1 on the previous page) When S1 is on, a termination resistor (110 Ohms) is connected between S/R (+) and S/R (-).

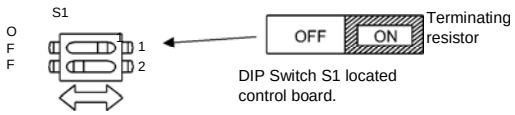
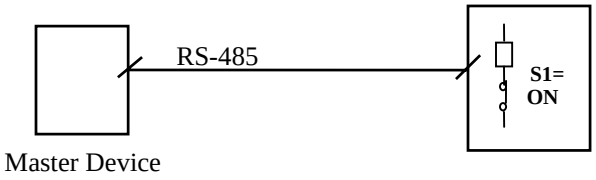
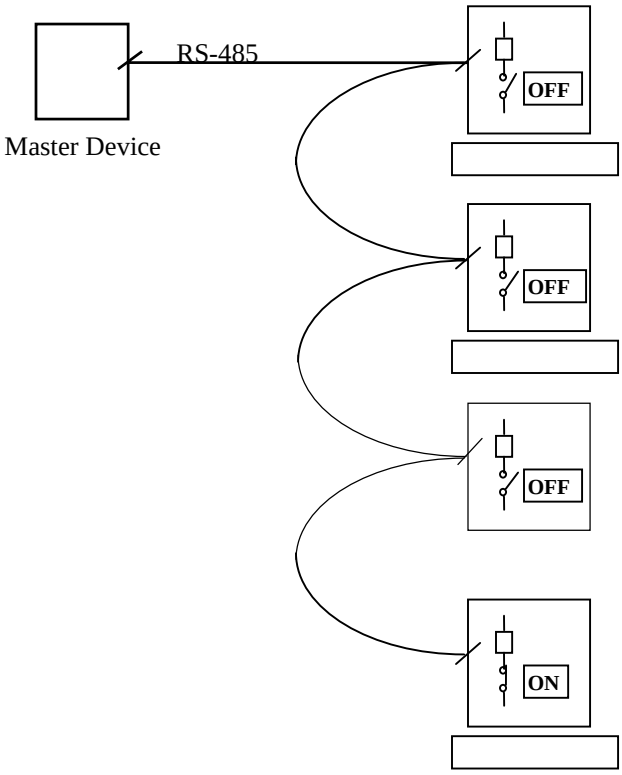


Figure 2-3. S1 Dip Switch

For one-to-one connections of the drive and a master device, set S1 to ON as shown below.



If multiple drives are connected to a master device, set S1 on the last drive to ON as shown below.



Chapter 3
Setting Impulse Series 3 Drive Parameters for Communication

- Run/Stop and Frequency Selection
- Communication Set up Parameters
- “ENTER” Command

Run/Stop and Frequency Selection

The run/stop commands and frequency reference command can originate from serial communication, the digital operator, the external terminals, or an option board. The origin of the run/stop command does not have to be the same as the origin for the frequency reference command. Parameter B3-01 (Reference Source) allows you to set up the origin of the frequency reference, and parameter B3-02 (Run Source) sets the origin of the run/stop commands. The charts shown below illustrate the possible frequency reference and run/stop selections.

Parameter B3-01 (196h) Setting	**Frequency Reference Selection**
0	Digital Operator
1	External Terminals
2	Serial Communication
3	Option Board
4	Pulse Input (H6 – 01)

The default setting of parameter B3-01 is ‘1’.

Parameter B3-02 (197h) Setting	**Operation Method Selection (Run/Stop)**
0	Digital Operator
1	External Terminals
2	Serial Communication
3	Option board

The default setting of parameter B3-02 is ‘1’.

NOTE: “CALL COMCALL” will be displayed on the keypad, along with an alarm condition, when B3-01 and B3-02 are set up for serial communications. This will clear automatically once communication has been initiated to the drive.

Serial Communication Set up Parameters

The IMPULSE Series 3 drive has parameters used for the set up of serial communication. These communication set up parameters are H5-01 through H5-07.

Parameter H5-01 - Serial Communication Address

Parameter H5-01 (or Modbus Register 425h) is used to set the Modbus slave address of the IMPULSE Series 3 drive. The slave address can be any number from 1 to 1F in hexadecimal (or 1 to 31 decimal). Two nodes may not have the same address. The default setting for parameter H5-01 is 1F.

Parameter H5-02 - Serial Communication Baud Rate Selection

Parameter H5-02 (or Modbus Register 426h) is used to select the baud rate. The table below indicates the baud rates that may be selected.

Setting Value (in hex)	Baud Rate Selection
0	1200 bps
1	2400 bps
2	4800 bps
3	9600 bps
4	19200 bps

The default setting of parameter H5-02 is '3'.

Parameter H5-03 - Serial Communication Parity Selection

Parameter H5-03 (or Modbus Register 427h) is used to select the parity. The table below indicates the parity that may be selected.

Setting Value (in hex)	Parity Selection
0	No parity
1	Even parity
2	Odd parity

The default setting of parameter H5-03 is '0'.

Communication Error (CE)

A communication error can occur only after communication has been established between the master and the IMPULSE Series 3 drive. The drive waits for the master to initiate communication.

The message data is always checked for CRC, parity, overrun, framing, and overflow. If the data has discrepancies in any of these areas a communication error will occur. If the IMPULSE Series 3 drive does not receive a message (addressed to its appropriate slave address set up in H5-01) within a period of 2 seconds, a time-out occurs. A time-out can also cause a communication error if it is enabled (see parameter H5-05).

Parameters H5-04 and H5-05 are the set up parameters that determine how the IMPULSE Series 3 drive will respond to a communication error.

Parameter H5-04 - Stopping Method after Serial Communication Error

Parameter H5-04 (or Modbus Register 428h) is used to determine the method of stopping the motor if there is a communication error. The table below indicates the stopping methods that can be used when a communication error occurs.

Setting Value (in hex)	Stopping Method
0	Decelerate to stop
1	Coast to stop
2	Fast Stop
3	Alarm Only / Continue Operation

The default setting of parameter H5-04 is '1'.

Parameter H5-05 - Serial Fault Detection Selection

Parameter H5-05 (or Modbus Register 429h) is used to enable or disable the Time-out detection. The table below indicates how to enable or disable the communication error.

Setting Value (in hex)	Time-out Detection Selection
0	Disabled
1	Enabled

The default setting of parameter H5-05 is '1'.

Parameter H5-06 – Transit Wait Time

Parameter H5-06 (or Modbus Register 42Ah) is used to set the wait time in between the drive receiving data and transmitting data, and is settable from 5-65 MS.

The default setting of parameter H5-06 is '5'.

Parameter H5-07 – RTS (Request to Send) Control Selection

Parameter H5-07 (or Modbus Register 42Bh) enables or disables RTS control

Setting	RTS Control
0	Disabled (RTS is always ON)
1	Enabled (RTS turns ON with sending)

The default setting of H5-07 is '1'.

Note: After changing any of the serial communication set-up parameters, power to the IMPULSE Series 3 drive must be cycled for the changes to be effective.

“ENTER” Command

The IMPULSE Series 3 drive has two types of memory: ‘Volatile’ and ‘Non-Volatile’. Data held in the Volatile memory will be lost when power is removed from the drive. Data held in Non-Volatile memory will be retained when power is removed from the drive. Different types of registers are stored in different areas of memory.

Command Data:
The command registers (000h to 00Fh) are stored in Volatile memory. When writing to a command register the new data becomes active immediately. In the case of a power loss all data stored in these registers will not be retained.

Monitor Data:
The monitor registers (010h to 03Fh) are stored in Volatile memory. These registers cannot be written to; they are read-only registers. Any data read from the monitor registers will not be retained during a power loss situation.

Parameter Data:
The parameter registers (40h to 708h) are stored in Non-Volatile memory. When writing new data to parameter registers, an ‘ENTER’ command must be given for the new data to become active.

There are two different types of ‘ENTER’ commands, ‘ACCEPT’ and ‘ENTER’. For an ‘ACCEPT’ command, write the value ‘0’ to Modbus register FFDDh. This causes data to become “active”. If a power loss occurs, the data will not be retained. For an ‘ENTER’ command, write the value ‘0’ to Modbus register FFFDh. This causes data to become “active” and saves the date to Non-Volatile memory. If a power loss occurs, the data will be retained.

Some parameter data registers may be written to while the drive is running. These parameters are called run operative parameters. For a list of these parameters, refer to Appendix C - Run Operative Parameters.

All other parameter data registers may only be written to when the drive is stopped. These are called non-run operative parameters.

If new data is written to any parameter serially, and is not followed by an ‘ENTER’ command, a “Busy Write Protected” message will flash on the digital operator display if an attempt is then made to change a parameter using the digital operator.

The same message will be displayed if an attempt is made to change a parameter via the digital operator while the contents of the ‘ENTER’ command register is any value other than ‘0’.

NOTE
Use the ‘ENTER’ (FFFDh) command only when necessary! The life of the EEPROM (Non-Volatile memory) on the IMPULSE Series 3 drive will support a finite number of operations. This means that the ‘ENTER’ command, value ‘0’ written to register FFFDh, can only be used a maximum of a 100,000 times to store data in the EEPROM. After the specified number of operations, the EEPROM may fault **(ERR)** requiring the IMPULSE Series 3 drive control board to be replaced.

Chapter 4
The Message Format

- Message Functions
- Read Multiple Registers
- Loop Back Test
- Write Multiple Registers
- No Response Message
- CRC-16

Message Functions

In communicating to the IMPULSE Series 3 drive via Modbus RTU, there are three message functions available. The master specifies the function to be executed by the slave according to the function code. The following table shows the types of function codes available, and the length (quantity) and contents of the message according to the function.

Function Code (hex)	Function	Command Message		Response Message (Normal)	
		min. (bytes)	max. (bytes)	min. (bytes)	max. (bytes)
3	Read Multiple Registers	8	8	7	37
8	Loop-back test	8	8	8	8
10	Write Multiple Registers	11	41	8	8

The message format varies depending upon the function of the message. For each function, there is a command message from the master and a response message initiated from the slave. The following sections review the format of the command message and the response message for each function.

Read Multiple Registers - 03h

The multiple register read function (03h) allows the master to request information from the slave. The command message of a multiple register read is structured as shown below.

Command Message

SLAVE ADDRESS		02h
FUNCTION CODE		03h
STARTING REGISTER NO.	UPPER	00h
	LOWER	40h
QTY.	UPPER	00h
	LOWER	04h
CRC-16	LOWER	2Fh
	UPPER	F3h

Each IMPULSE Series 3's slave address is set in advance by the drive parameter H5-01. Valid slave addresses must be in the range of 1 to 31 decimal (1 to 1F hex). No two slaves may have the same address. The master addresses the slave by placing the slave address in the address field of the message. In the command message above, the slave is addressed at 2.

The function code of this message is 03h (read multiple registers).

The starting number is the first register to be read. In the command message above the starting register is 20h, indicating that the first register is the Frequency Reference. A listing of the IMPULSE Series 3 drive registers is shown in Chapter 7, Registers.

The quantity indicates how many consecutive registers are to be read. The quantity may range from 1 to 16 registers. If the quantity is greater than 16, an error code of '3' is returned in the fault response message. In this command message there are four consecutive registers to be read: 40h-Frequency Reference, 41h-Output Frequency, 42h-Output Current, and 43h-Control Method.

A CRC-16 value is generated from a calculation using the values of the address, function code, and data sections of the message. The procedure for calculating a CRC-16 is described at the end of this chapter. When the slave receives the command message it calculates a CRC-16 value and compares it to the one in CRC-16 field of the command message. If these two CRC-16 values are the same the slave has received the proper command message. If the two CRC-16 values are not the same the slave will not respond.

If the command message has a valid slave address, function code, starting register, and quantity value, the slave will respond with a normal response message. If the command message has an invalid slave address, function code, starting register, and/or quantity the slave will respond with a fault response message.

Normal Response Message

SLAVE ADDRESS		02h
FUNCTION CODE		03h
NO. OF DATA BYTES		08h
STARTING REGISTER NO.	UPPER	17h
	LOWER	70h
NEXT REGISTER CONTENTS	UPPER	17h
	LOWER	70h
NEXT REGISTER CONTENTS	UPPER	01h
	LOWER	90h
NEXT REGISTER CONTENTS	UPPER	00h
	LOWER	00h
CRC-16	LOWER	ADh
	UPPER	D2h

The starting register, 40h (Frequency Reference), has a value of 1770h or 6000 dec. (60.00 Hz)

The next register, 41h (Output Frequency), has

The next register, 42h (Output Current), has a value of 109h or 265 dec. (drive rating / 8192).

The next register, 43h (Control Method), has a value of 00h or 0 dec. (V/f Control).

The normal response message contains the same slave address and function code as the command message, indicating to the master which slave is responding and to what type of function it is responding.

The number of data bytes is the number of data bytes returned in the response message. The number of data bytes is actually the quantity (in the command message) times 2, since there are two bytes of data in each register.

The data section of the response message contains 8 upper and 8 lower bits of data for each register that has been read from the drive.

A CRC-16 value is generated from a calculation using the values of the address, function code, number of data bytes, and register data sections of the message. The procedure for calculating a CRC-16 value is described at the end of this chapter. How the response message is handled by the master depends on what master is used. When the master receives the response message it should calculate a CRC-16 value and compare it to the one in the CRC-16 field of the response message. If these two CRC-16 values are the same, the master has received the proper response message.

Fault Response Message

SLAVE ADDRESS		02h
80h + FUNCTION CODE		83h
ERROR CODE		02h
CRC-16	LOWER	30h
	UPPER	F1h

The fault response message contains the same slave address as the command message, indicating to the master which slave is responding.

The function code of a fault response message is actually a value of 80h plus the original function code of 03h. This indicates to the master that the message is a fault response message, instead of a normal response message.

The error code indicates where the error occurred in the command message. The value of 2h in the error code field of this fault response message indicates that the command message requested data be read from an invalid register. A complete listing of the error codes is shown in Chapter 8, Troubleshooting and Error Codes.

A CRC-16 value is generated from a calculation using the values of the address, function code, and error code sections of the message. The procedure for calculating a CRC-16 value is described at the end of this chapter. How the response message is handled by the master depends on what master is used. When the master receives the fault response message it should calculate a CRC-16 value and compare it to the one in the CRC-16 field of the fault response message. If these two CRC-16 values are the same, the master has received the proper fault response message.

Loop-back Test - 08h

The loop-back test function (08h) is used for checking signal transmission between master and slaves. The command message format is shown below.

Command Message

SLAVE ADDRESS		01h
FUNCTION CODE		08h
TEST CODE	UPPER	00h
	LOWER	00h
DATA	UPPER	A5h
	LOWER	37h
CRC-16	LOWER	DAh
	UPPER	8Dh

Each IMPULSE Series 3 drive's slave address is set in advance by the drive parameter H5-01. Valid slave addresses must be in the range of 1 to 31 decimal (1 to 1F hex). No two slaves may have the same address. The master addresses the slave by placing the slave address in the address field of the message. In the command message above, the slave is addressed at 1.

The function code of this message is 08h (loop-back test).

The test code must be set to '0000'. This function specifies that the data passed in the command message be returned (looped back) in the response message.

The data section contains arbitrary data values. These data values are used to verify that the slave receives the correct data.

A CRC-16 value is generated from a calculation using the values of the address, function code, test code, and data sections of the message. The procedure for calculating a CRC-16 is described at the end of this chapter. When the slave receives the command message it calculates a CRC-16 value and compares it to the one in CRC-16 field of the command message. If these two CRC-16 values are the same, the slave has received the proper command message. If these two CRC-16 values are not the same, the slave does not respond.

If the command message has a valid slave address, function code, test code, and data value, the slave will respond with a normal response message. If the command message has an invalid slave address, function code, test code, and/or data value, the slave will respond with a fault response message.

Normal Response Message

SLAVE ADDRESS		01h
FUNCTION CODE		08h
TEST CODE	UPPER	00h
	LOWER	00h
DATA	UPPER	A5h
	LOWER	37h
CRC-16	LOWER	DAh
	UPPER	8Dh

A normal response message for the loop-back test should be identical to the command message.

Fault Response Message

SLAVE ADDRESS		01h
FUNCTION CODE		88h
ERROR CODE		01h
TEST CODE	UPPER	00h
	LOWER	00h
CRC-16	LOWER	80h
	UPPER	62h

The fault response message contains the same slave address as the command message, indicating to the master which slave is responding.

The function code of a fault response message is actually a value of 80h plus the original function code of 08h. This indicates to the master that the message is a fault response message instead of a normal response message.

The error code indicates where the error occurred in the command message. A complete listing of the error codes is shown in Chapter 8, Troubleshooting and Error Codes.

A CRC-16 value is generated from a calculation using the values of the address, function code, and data sections of the message. The procedure for calculating a CRC-16 value is described at the end of this chapter. How the response message is handled by the master depends on what master is used. When the master receives the fault response message it should calculate a CRC-16 value and compare it to the one in the CRC-16 field of the fault response message. If these two CRC-16 values are the same, the master has received the proper fault response message.

Write Multiple Registers - 10h

The multiple register write function (10h) allows the master to write data to the IMPULSE Series 3 drive's registers. The multiple register write message format is shown below.

Command Message

SLAVE ADDRESS		01h
FUNCTION CODE		10h
STARTING REGISTER NO.	UPPER	00h
	LOWER	01h
QTY.	UPPER	00h
	LOWER	02h
NO. OF DATA BYTES		04h
DATA TO FIRST REGISTER	UPPER	00h
	LOWER	01h
DATA TO NEXT REGISTER	UPPER	17h
	LOWER	70h
CRC-16	LOWER	6Dh
	UPPER	B7h

The first register, 01h (Operation Command) has a value of 01h or 1 dec. (forward run command)

The next register, 02h (Frequency Reference) has a value of 1770h or 6000 dec. (60.00 Hz)

Each Series 3 drive's slave address is set in advance by the drive parameter H5-01. Valid slave addresses must be in the range of 1 to 31 decimal (1 to 1F hex). No two slaves may have the same address. The master addresses the slave by placing the slave address in the address field of the message. In the command message above, the slave is addressed at 1.

By setting the slave address to zero (0) in the address section of the message, the master can send operation signals (register 1h) and frequency reference (register 2h) to all slaves on the network. The master can send a single transmission to all the slaves simultaneously. This is called simultaneous broadcasting. In a simultaneous broadcast message all of the slaves on the network act upon one message.

The function code of this message is 10h (write multiple registers).

The starting register number is the first register to be written to. In the command message above the starting number is 01h, indicating that the first register is the Run command. A listing of the IMPULSE Series 3 drive registers is shown in Chapter 5, Registers.

The quantity indicates how many consecutive registers are to be written to. The quantity may range from 1 to 16 registers. If the quantity is greater than 16, an error code of '3' is returned in the fault response message. In this command message there are two consecutive registers to be written to: 01h-Operation Command and 02h- Frequency Reference.

The number of data bytes is the number of bytes of data to be written to the drive. The number of data bytes is actually the quantity times 2, since there are two bytes of data in each register.

The data section of the response message contains 8 upper and 8 lower bits of data for each register that is being written to.

A CRC-16 value is generated from a calculation using the values of the address, function code, starting register number, quantity, number of data bytes, and data sections of the message. The procedure for calculating a CRC-16 is described at the end of this chapter. When the slave receives the command message it calculates a CRC-16 value and compares it to the one in CRC-16 field of the command message. If these two CRC-16 values are the same, the slave has received the proper command message. If these two CRC-16 values are not the same, the slave does not respond.

If the command message has a valid slave address, function code, starting register number, quantity, number of data bytes, and data values, the slave will respond with a normal response message. If the command message has an invalid slave address, function code, starting register number, quantity, number of data bytes, and/or data values the slave will respond with a fault response message.

Normal Response Message

SLAVE ADDRESS		01h
FUNCTION CODE		10h
STARTING REGISTER NO.	UPPER	00h
	LOWER	01h
QTY.	UPPER	00h
	LOWER	02h
CRC-16	LOWER	09h
	UPPER	CCh

The normal response message contains the same slave address and function code as the command message, indicating to the master which slave is responding and to what type of function it is responding.

The starting number is the first register that was written to. In the response message above the starting number is 01h, indicating that the first register is the operation command.

The quantity indicates how many consecutive registers were written to.

A CRC-16 value is generated from a calculation using the values of the address, function code, starting register number, and quantity value of the message. The procedure for calculating a CRC-16 value is described at the end of this chapter. How the response message is handled by the master depends on what master is used. When the master receives the response message it should calculate a CRC-16 value and compare it to the one in the CRC-16 field of the response message. If these two CRC-16 values are the same the master has received the proper response message.

Fault Response Message

SLAVE ADDRESS		01h
80h + FUNCTION CODE		90h
ERROR CODE		02h
CRC-16	LOWER	00h
	UPPER	95h

The fault response message contains the same slave address as the command message, indicating to the master which slave is responding.

The function code of a fault response message is actually a value of 80h plus the original function code of 10h. This indicates to the master that the message is a fault response message, instead of a normal response message.

The error code indicates where the error occurred in the command message. The value of 2h in the error code field of this fault response message, indicates that the command message requested data to be written to an invalid register. A complete listing of the error codes is shown in Chapter 8, Troubleshooting and Error Codes.

A CRC-16 value is generated from a calculation using the values of the address, function code, and error code sections of the message. The procedure for calculating a CRC-16 value is described at the end of this chapter. How the response message is handled by the master depends on what master is used. When the master receives the fault response message it should calculate a CRC-16 value and compare it to the one in the CRC-16 field of the response message. If these two CRC-16 values are the same the master has received the proper response message.

No Response Message

The slave disregards the command message and does not return the respond message in the following cases:

1. In simultaneous broadcasting of data (slave address field is 0), all slaves execute but do not respond.
2. When a communication error (overrun, framing, parity, or CRC-16) is detected in the command message.
3. When the slave address in the command message does not coincide with the address set in the slave.
4. When the command message data length is not proper.

CRC-16

At the end of the message, the data for CRC error checking is sent in order to detect errors in signal transmission. In Modbus RTU, the error check is conducted in the form of a CRC-16 (Cyclical Redundancy Check). The CRC field checks the contents of the entire message. It is applied regardless of any parity check method used for the individual characters of the message.

The CRC field is two bytes, containing 16-bit binary value. The CRC value is calculated by the transmitting device, which appends the CRC to the message. The receiving device recalculates a CRC during receipt of the message, and compares the calculated value to the actual value it received in the CRC field. If the two values are not equal, an error results.

The CRC is started by first preloading a 16-bit register to all 1's. Then a process begins of applying successive 8-bit bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC. Start and stop bits, and the parity bit (if one is used) do not apply to the CRC.

During generation of the CRC, each 8-bit character is exclusive 'OR'ed with the register contents. Then the result is shifted in the direction of the least significant bit (LSB), with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB is a 1, the register is then exclusive 'OR'ed with a preset, fixed value (A001h). If the LSB is a 0, no exclusive OR takes place.

This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next 8-bit byte is exclusive 'OR'ed with the register's current value, and the process repeats for eight more shifts as described above. The final contents of the register, after all the bytes of the message have been applied, is the CRC value.

For applications using a host computer, a detailed example of a CRC generation using Quick Basic is shown on the following page.

Typical CRC-16 Calculation Program in Quick Basic:

```
crcsum# = &HFFFF&
crcshift# = &H0&
crcconst# = &HA001&

CLS
PRINT "**************************************************"
PRINT
PRINT "              CRC-16 calculator"
PRINT
PRINT "**************************************************"
PRINT "If entering data in hex, precede the data with '&H'"
PRINT "       Example:  32decimal = 20hex = &H20"
PRINT "**************************************************"
PRINT

INPUT "Enter the number of bytes in the message: ", maxbyte

FOR bytenum = 1 TO maxbyte STEP 1
      PRINT "Enter byte "; bytenum; ":":
      INPUT byte&
      byte& = byte& AND &HFF&
      crcsum# = (crcsum# XOR byte&) AND &HFFFF&
      FOR shift = 1 TO 8 STEP 1
            crcshift# = (INT(crcsum# / 2)) AND &H7FFF&
            IF crcsum# AND &H1& THEN
                  crcsum# = crcshift# XOR crcconst#
            ELSE
                  crcsum# = crcshift#
            END IF
      NEXT shift
NEXT bytenum

lower& = crcsum# AND &HFF&
upper& = (INT(crcsum# / 256)) AND &HFF&

PRINT "Lower byte (1st) = ", HEX$(lower&)
PRINT "Upper byte (2nd) = ", HEX$(upper&)
```

CRC-16 Calculation Example:

A two byte message for a read-out of a specified coil status is as follows.

0000 0010	Slave Address = 2
0000 0111	Function Code = 7

The actual CRC calculation would look like this:

CRCTMP	FLAG	
1111 1111 1111 1111		Initial Value
0000 0010		Slave Address
1111 1111 1111 1101		Result of EX
OR		
0111 1111 1111 1110	1	Shift #1
1010 0000 0000 0001		CRC-16
constant A001h		
1101 1111 1111 1111		Result of EX
OR		
0110 1111 1111 1111	1	Shift #2
1010 0000 0000 0001		CRC-16
constant A001h		
1100 1111 1111 1110		Result of EX
OR		
0110 0111 1111 1111	0	Shift #3
0011 0011 1111 1111	1	Shift #4
1010 0000 0000 0001		CRC-16
constant A001h		
1001 0011 1111 1110		Result of EX
OR		
0100 1001 1111 1111	0	Shift #5
0010 0100 1111 1111	1	Shift #6
1010 0000 0000 0001		CRC-16
constant A001h		
1000 0100 1111 1110		Result of EX
OR		
0100 0100 0111 1111	0	Shift #7
0010 0001 0011 1111	1	Shift #8
1010 0000 0000 0001	CRC-16 constant A001h	
1000 0001 0011 1110		Result of EX
OR		
0000 0111		Function Code
1000 0001 0011 1001		Result of EX
OR		
0100 0000 1001 1100	1	Shift #1
1010 0000 0000 0001		CRC-16
constant A001h		
1110 0000 1001 1101		Result of EX
OR		
0111 0000 0100 1110	1	Shift #2
1010 0000 0000 0001		CRC-16
constant A001h		
1101 0000 0100 1111		Result of EX
OR		
0110 1000 0010 0111	1	Shift #3
1010 0000 0000 0001		CRC-16
constant A001h		
1100 1000 0010 0110		Result of EX
OR		
0110 0100 0001 0011	0	Shift #4
0011 0010 0000 1001	1	Shift #5
1010 0000 0000 0001		CRC-16
constant A001h		
1001 0010 0000 1000		Result of EX
OR		
0100 1001 0000 0100	0	Shift#6
0010 0100 1000 0010	0	Shift #7
0001 0010|0100 0001	0	Shift #8
1 2 | 4 1		
CRC-16 (Upper 8) | CRC-16 (Lower 8)		

After calculating the CRC-16 upper and lower values they are inserted into the message format as shown below.

0000 0010	Slave Address = 2
0000 0111	Function Code = 7
0100 0001	CRC-16 Lower = 41h
0001 0010	CRC-16 Upper = 12h

Chapter 5
Registers

- Command Registers
- Monitor Registers
- IMPULSE Series 3 Drive Parameter Registers
- Special Registers

Command Registers (Read/Write)

REGISTER (in hex)	FUNCTION	BIT NO.	DATA SET	DESCRIPTION
001h	Operational Command	0	0	Stop Forward
			1	Run Forward
		1	0	Stop Reverse
			1	Run Reverse
		2	1	External Fault (EFO)
		3	1	Fault Reset
		4	ComRef - Freq. Ref by memobus regardless of B3-01 setting. (Will not work when COM-)	
		5	ComCtrl - Run Ref by memobus regardless of B3-02 setting. (Option card is installed)	
		6	Terminal 3 Function **(1)**	
		7	Terminal 4 Function **(1)**	
		8	Terminal 5 Function **(1)**	
		9	Terminal 6 Function **(1)**	
		A	Terminal 7 Function **(1)**	
		B	Terminal 8 Function **(1)**	
		C - F	Not Used	
002h	Frequency Reference		Frequency Reference (6000 = 60.00Hz) **(7)**	
003h	Torque Reference/Torque Limit		Flux Vector mode only (0.1%)	
004h	Torque Compensation		Flux Vector mode only (0.1%)	
005h	Not Supported			
006h	PID Setpoint			
007h	Analog Output 1 Setting		(-11V/-1540 to 11V/1540) **(5)**	
008h	Analog Output 2 Setting		(-11V/-1540 to 11V/1540) **(6)**	
009h	Digital Output Setting	0	Multi-function Contact Output (terminals M0 – M1): “closed” **(2)**	
		1	Multi-function Contact Output (terminals M2 – M4): “closed” **(3)**	
		2	Multi-function Contact Output (terminals M5 – M6): “closed” **(4)**	
		3 ~ 5	Not Used	
		6	Fault Contact (Terminal MA – MB) enable	
		7	Fault Contact state (Terminal MA – MB) (effective only when bit 6 = ‘1’)	
		8 ~ F	Not Used	

(1) The availability of the MFI terminals vary depending upon the settings of H1-01, H1-02, H1-03, H1-04, H1-05, H1-06 (the multi-function input settings)
(2) Effective when H2-01 = 0Fh. (3) Effective when H2-02 = 0Fh. (4) Effective when H2-03 = 0Fh.
(5) Effective when H4-01 = 31h. (6) Effective when H4-04 = 31h.
(7) Desired frequency of 35.75 Hz requires a value of 3575 in register data code 002h. Scaling depends on the setting of o1-03

Command Registers (Read/Write) - Continued

REGISTER (in hex)	FUNCTION	BIT NO.	DESCRIPTION
000Fh	Command Selection Setting	0	Not Used
		1	Enables PID value from register 0006h
		2 ~ B	Not Used
		C	Enables Batch Data Transfer Terminal 5 Input
		D	Enables Batch Data Transfer Terminal 6 Input
		E	Enables Batch Data Transfer Terminal 7 Input
		F	Enables Batch Data Transfer Terminal 8 Input

Monitor Registers (Read Only)

REGISTER (in hex)	FUNCTION	BIT NO.	DESCRIPTION	
0010h	Drive Status	0		Run
		1		Zero-Speed
		2		Reverse Run
		3		Reset Signal Input
		4		Speed Agree
		5		Drive Operation Ready
		6		Minor Fault (Alarm)
		7		Major Fault (Fault)
		8 ~ 10		Not Used
		E		Com Ref Status
		F		Com Ctrl Status
0011h	Operator Status	0		OPE has Occured
		1		ERR has Occurred
		2		Program Mode
		3		0: Operator 1: PC
		4 ~ F		Not Used
0012h	OPE Number			OPE Description Number
0013h	Inverter Code			G5: 0000h V7: 2040h F7: 2040h

Monitor Registers (Read Only) - Continued

REGISTER (in hex)	FUNCTION	BIT NO.	DESCRIPTION
0014h or 0730h	Existing Fault Code 1	0	PUF – Fuse Blown
		1	UV1 - DC Bus Undervoltage
		2	UV2 - CTL PS Undervoltage
		3	UV3 - MC Answerback
		4	Not Used
		5	GF - Ground Fault
		6	OC - Over Current
		7	OV – Overvoltage
		8	OH - Heatsink Overtemperature
		9	OH1 - Drive Overheat
		A	OL1 - Motor Overload
		B	OL2 - Drive Overload
		C	OT1 - Overtorque 1
		D	OT2 - Overtorque 2
		E	RR - Dynamic Braking Transistor
		F	RH - Dynamic Braking Resistor Overheat
0015h or 0731h	Existing Fault Code 2	0	EF3 - External Fault 3
		1	EF4 - External Fault 4
		2	EF5 - External Fault 5
		3	EF6 - External Fault 6
		4	EF7 - External Fault 7
		5	EF8 - External Fault 8
		6	PGO-1-h - PG CH 1 Open (Hardware Detection)
		7	OS-1 – CH 1Overspeed
		8	DEV-1 - Speed Deviation
		9	PGO-1-S – PG CH 1 Open (Software Detection)
		A	PF - Input Phase Loss
		B	LF - Output Phase Loss
		C	OH3 – Motor Overheat
		D	OPR – Operator Disconnect
		E	ERR - EEPROM R/W Error
		F	OH4 – Motor Overheat 2

Monitor Registers (Read Only) - Continued

REGISTER (in hex)	FUNCTION	BIT NO.	DESCRIPTION
0016h or 0732h	Existing Fault 3	0	CE – Modbus Com Error
		1	BUS – Option Communication Error
		2	E15 – Serial Communication Error
		3	E10 – Option CPU Down
		4	CF – Out of Control
		5	SVE – Zero Servo Fault
		6	EFO – Communication Option External Fault
		7	FBL – PID Feedback Loss
		8	UT1 – Undertorque 1
		9	UT2 – Undertorque 2
		A	OL7 – High Speed Slip Braking Overload
		B	PGO-2-H – PG CH2 Open (Hardware Detection)
		C	OS-2 – CH2 Overspeed
		D	DEV-2 – CH2 Speed Deviation
		E	PG)-S-S – PG CH2 Open (Software Detection)
		F	Not used
0733h	Existing Fault 4	0	Not Used
		1	Not Used
		2	SNAP – Snapped Shaft
		3	LC - Load Check Error
		4	BE1 – Rollback Detected
		5	BE2 – No Current
		6	BE3 – Brake Release No Good
		7	BE7 – Brake Welded
		8	UL3 – Upper Limit 3
		9 ~ F	Not Used

Monitor Registers (Read Only) - Continued

REGISTER (in hex)	FUNCTION	BIT NO.	DESCRIPTION
0017h	CPF Description 1	0 ~ 1	Not Used
		2	CPF02 – Baseblock Circuit
		3	CPF03 – EEPROM Fault
		4	CPF04 – CPU Internal A/D Converter
		5	CPF05 – External A/D Converter
		6	CPF06 – Option Board Connection Error
		7	CPF07 – ASIC Internal RAM Error
		8	CPF08 – Watchdog Timer Fault
		9	CPF09 – CPU-ASIC Mutual Diagnosis Fault
		A	CPF10 – ASIC Version Fault
		B ~ F	Not Used
0018h	CPF Description 2	0	CPF20 – Option A/D Error
		1	CPF21 – Option CPU Down
		2	CPF22 – Option Type Error
		3	CPF23 – Option Board Interconnection Fault
		4 ~ F	Not Used
0019h or 734h	Minor Fault Content 1 (Alarm)	0	UV - DC Bus Undervoltage (No run command)
		1	OV - DC Bus Overvoltage (No run command)
		2	OH - Inverter Overheat
		3	OH2 - Inverter Overheat Warning by MFDI '39H'
		4	OT1 - Overtorque 1
		5	OT2 - Overtorque 2
		6	EF - External Fault (F/R simultaneously)
		7	BB - External Baseblock
		8	EF3 - External Fault Terminal 3
		9	EF4 - External Fault Terminal 4
		A	EF5 - External Fault Terminal 5
		B	EF6 - External Fault Terminal 6
		C	EF7 - External Fault Terminal 7
		D	EF8 - External Fault Terminal 8
		E	SNAP - Snapped Shaft
		F	OS-1 - CH1 Overspeed

Monitor Registers (Read Only) - Continued

REGISTER (in hex)	FUNCTION	BIT NO.	DESCRIPTION
001Ah or 735h	Minor Fault Content 2 (Alarm)	0	DEV-1 - CH1 Speed Deviation
		1	PGO-1-S - PG CH1 Open (Software Detection)
		2	PGO-1-H - PG CH1 Open (Hardware Detection
		3	CE - Memobus Communication Error
		4	BUS - Communication Option Error
		5	CALL - Serial Comm has not been established (Communication Option)
		6	LC - Load Check Error
		7	BE0 - Brake Answerback Lost durring run
		8	DEV-2 - CH2 Speed Bias Exceeded
		9	EF0 - Communication Option External Fault
		A	Can't SW - Motor Switch During Run
		B	FBL - PID Feedback Loss
		C	CALL - Serial Comm has not been established (Memobus)
		D	UT1 - Undertorque 1
		E	UT2 - Undertorque 2
		F	Communication TEST Error
001Bh or 736h	Minor Fault Content 3 (Alarm)	0	OS-2 - CH2 Overspeed
		1	OH3 - Motor Overheat 1
		2	DNE - Drive not Ready
		3	PGO-2-S - PG CH2 Disconnect (Software Detection)
		4	PGO-2-H - PG CH2 Disconnet (Hardware Detection)
		5	BE4 - Brake Answer 1 (Start of Run)
		6	BE5 - Brake Answer 2 (End of Run)
		7	BE6 - Brake Slipping
		8	UL2 - Upper Limit 2
		9	LL2 - Lower Limit 2
		A	UL1 - Upper Limit 1
		B	LL1 - Lower Limit 1
		C	SLC - Slack Cable Detect
		D	MNT - Maintenance Required
		E	KLX - Klixon
		F	UL3 - Upper Limit 3
737h	Minor Fault Content 4 (Alarm)	0	BE8 – Brake Slipping (Load Catch)
		1 ~ F	Not Used (Future Alarms)

Monitor Registers (Read only) - Continued

REGISTER (in hex)	FUNCTION	BIT NO.	DESCRIPTION
0020h	Drive Status	0	Running
		1	Reverse Run
		2	Drive Operation Ready
		3	Drive Fault
		4	Data Setting Error
		5	Multi-Function Digital Output (Terminal M0 – M1)
		6	Multi-Function Digital Output (Terminal M2 – M4)
		7	Multi-Function Digital Output (Terminal M5 – M6)
		8 ~ F	Not Used
0021h	Major Fault Content	0	OC -Overcurrent, GF - Ground Fault
		1	OV - DC Bus Overvoltage
		2	OL2 - Inverter Overload
		3	OH1, OH2 Inverter Overheat
		4	RR - Braking Transistor Fault, RH - Internal Braking Resister Overheat
		5	PUF - Fuse Blown
		6	FbL - PID Feedback Loss
		7	External Fault (EF, EF0)
		8	CPF Hardware Fault
		9	OL1, OT1, OT2
		A	PGO-1-S, OS-1, DEV-1
		B	UV - DC Bus Undervoltage (No run command)
		C	UV1, UV2, UV3 Power Loss while running
		D	SPO - Output Phase, SPI - Input Phase
		E	CE - Memobus Communication Error
		F	OPR - Operator Connection Fault while running from operator
0022h	Data Link Status	0	Writing Data
		1 ~ 2	Not Used
		3	Parameter Upper/Lower Limit Fault
		4	Parameter Data Inconsistency Fault
		5 ~ F	Not Used
0023h	Frequency Reference	U1-01	
0024h	Output Frequency	U1-02	
0025h	Output Voltage	U1-06	

Monitor Registers (Read only) - Continued

REGISTER (in hex)	FUNCTION	BIT NO.	DESCRIPTION
0026h	Output Current	U1-03	
0027h	Output Power	U1-08	
0028h	Torque Reference	U1-09	
002Bh	Digital Input Status	0	Terminal 1 (Closed)
		1	Terminal 2 (Closed)
		2	Terminal 3 (Closed)
		3	Terminal 4 (Closed)
		4	Terminal 5 (Closed)
		5	Terminal 6 (Closed)
		6	Terminal 7 (Closed)
		7	Terminal 8 (Closed)
002Ch	Drive Status	0	During Run
		1	During Zero Speed
		2	During Speed Agree (Fixed: (Fref = Fout) or (Fref = Motor Speed)) (Width by L4-02)
		3	During Speed Agree (Programmable by L4-01, L4-02)
		4	Frequency Detection 1
		5	Frequency Detection 2
		6	Inverter Ready
		7	Undervoltage During Detection
		8	During Baseblock
		9	Frequency Reference Mode 1: Not from Comm.
		A	Run Command Mode 1: Not from Comm.
		B	Overtorque During Detection
		C	During Frequency Reference Loss
		D	During Fault Restart (Auto Reset)
		E	During Fault
		F	Memobus Timed Out
002Dh	Multi-Function Output Status	0	Multi-Function Output (Terminal M0, M1)
		1	Multi-Function Output (Terminal M2 ~ M4)
		2	Multi-Function Output (Terminal M5, M6)
		3 ~ F	Not Used
0031h	DC Bus Voltage	U1-07	
0032h	Torque Reference	U1-09	
0033h	Output Power	U1-08	
0038h	PID Setpoint	U1-24	

Monitor Registers (Read only) - Continued

REGISTER (in hex)	FUNCTION	BIT NO.	DESCRIPTION
0039h	PID Input	U1-36	
003Ah	PID Output	U1-37	
003Bh	CPU Software Number	U1-28	
003Ch	Flash Software Number	U1-114	
003Dh	Comm. Error Description	0	CRC Error
		1	Data Length Error
		2	Not Used
		3	Parity Error
		4	Overrun Error
		5	Framing Error
		6	Timed Out
		7 ~ F	Not Used
003Eh	KVA Setting	Drive KW Rating	
003Fh	Control Mode	Control Method	

Drive Parameter Registers (U1-xx / Monitor Only)

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	BIT NO.	LIMITS / DESCRIPTION
040h	U1-01	Frequency Reference	Frequency Reference of drive (0.1 Hz) **(1)**		
041h	U1-02	Output Frequency	Output Frequency of drive (0.1 Hz) **(1)**		
042h	U1-03	Output Current	10V/Drive rated current **(2)**		
043h	U1-04	Control Method	0		V/f Control
			1		V/f with PG Feedback
			2		Open Loop Vector
			3		Flux Vector
044h	U1-05	Motor Speed	Motor Speed (in 0.1 Hz)		
045h	U1-06	Output Voltage	Output Voltage (in 0.1 V)		
046h	U1-07	DC Bus Voltage	DC Bus Voltage (in 1 V)		
047h	U1-08	Output Power	Output Power (in 0.1 kW)		
048h	U1-09	Torque Reference	Torque Reference (in 0.1%)		
049h	U1-10	Input Terminal Status		0	Input Terminal 1 closed
				1	Input Terminal 2 closed
				2	Input Terminal 3 closed
				3	Input Terminal 4 closed
				4	Input Terminal 5 closed
				5	Input Terminal 6 closed
				6	Input Terminal 7 closed
				7	Input Terminal 8 closed
04Ah	U1-11	Output Terminal Status		0	Control Circuit terminals M0, M1: “Closed”
				1	Control Circuit terminals M2 ~ M4: “Closed”
				2	Control Circuit terminals M5, M6: “Closed”
				3-6	Not Used
				7	Control Circuit terminals MA ~ MC: “Closed”

Notes:
(1) Scaling depends on the setting of o1-03.
(2) Display unit = 0.01A for models IMPULSE Series 3 2003 thru 2025 and 4001 thru 4011; display unit = 0.1A for models 2033 - 2300 and 4014 - 4605.

Drive Parameter Registers (U1-xx / Monitor Only) – Continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	BIT NO.	LIMITS / DESCRIPTION
04Bh	U1-12	Operation Status		0	Run
				1	Zero-Speed
				2	Reverse Run
				3	Reset Signal Input
				4	Speed Agree
				5	Drive Operation Ready
				6	Minor Fault
				7	Major Fault
04Ch	U1-13	Elapsed Time	Hours		
04Dh	U1-14	Software No. (CPU ID No.)	Software version number		
04Eh	U1-15	Control Circuit Term A1 Input Voltage	Input voltage signal at terminal A1 (+10V / +100.0% ~ -10V / -100.0%)		
04Fh	U1-16	Control Circuit Term A2 Input Voltage	Input voltage or mAmp signal at terminal A2 (+10V / +100.0% ~ -10V / -100.0%) or (4mA / 0.0% ~ 20mA / 100.0%)		
050h	U1-17	Control Circuit Term A3 Input Voltage	Input voltage signal at terminal A3 (+10V / +100.0% ~ -10V / -100.0%)		
051h	U1-18	Motor Secondary Current (Iq)	Motor Secondary Current-Iq (0.1%)		
052h	U1-19	Motor Exciting Current (Id)	Motor Rated Primary Current-Id (0.1%)		
053h	U1-20	Output Frequency after Soft-start	Max. Output Frequency (0.1 Hz)		
054h	U1-21	Automatic Speed Regulator (ASR) Input	ASR Input (0.01%)		
055h	U1-22	Automatic Speed Regulator (ASR) Output	ASR Output (0.01%)		
056h	U1-23	PG-Z2 CH2 Detection Speed	PG-Z2 CH2 Detection Speed (0.01%)		
057h	U1-24	PID Feedback Amount	PID Feedback Amount (0.01%)		
058h	U1-25	G5 IN4 Reference	Input value according to the setting of F3-01		
059h	U1-26	Output Voltage Reference Vq	Output Voltage-Vq (0.1V)		
05Ah	U1-27	Output Voltage Reference Vd	Output Voltage-Vd (0.1V)		
05Bh	U1-28	Software No. CPU	processor version number		
05Ch	U1-29	Load Weight	Weight Measurement		
05Dh	U1-30	SS Delta Speed	Snap Shaft Speed Difference		
05Eh	Not Used				
05Fh	U1-32	ACR Output q Axis	ASR Output q Axis (0.1%)		
060h	U1-33	ACR Output d Axis	ASR Output d Axis (0.1%)		
061h	U1-34	OPE Detection	Parameter setting error		
062h	U1-35	Zero Servo Motion Pulse	Pulse Count During Zero Servo		
063h	U1-36	PID Input	PID Input (0.00%)		
064h	U1-37	PID Output	PID Output (0.00%)		
065h	U1-38	PID Setpoint	PID Setpoint (0.00%)		

Drive Parameter Registers (U1-xx / Monitor Only) – Continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	BIT NO.	LIMITS / DESCRIPTION
066h	U1-39	Memobus Communication Error			
067h	U1-40	FAN Accumulated Operation Time			
068h	U1-41	Cooling Fin Temperature			
069h	Not Used				
06Ah	Not Used				
06Bh	U1-44	ASR Output	ASR Out No Filter		
06Ch	Not Used				
06Dh	Not Used				
06Eh	Not Used				
06Fh	Not Used				
070h	U1-49	CPU Occupation Rate	Amount of CPU Resources Being Used		
071h	U1-50	Hook Height	Calculated Height of Hook (0.00%) (Height Measurement)		
072h	U1-51	Motor Revolution	Number of Motor Revolutions Since Upper Limit (UL2) (Height Measurement)		
073h	U1-52	Maintenance Timer	Number of Hours Remaining Before Maintenance is Required		
074h	U1-53	Inch 2 Count	Number of Pulses Encoder has Moved Since Inch 2 Command		

Drive Parameter Registers (U2-xx / Fault Trace and U3-xx / Fault History)

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	BIT NO.	LIMITS / DESCRIPTION
080h	U2-01	Current Fault	Code of current fault **(1)**		
081h	U2-02	Last Fault	Code of second to current fault **(1)**		
082h	U2-03	Frequency Ref. at Fault	Frequency Reference at the time of the current fault (0.0 to 400.0 Hz)		
083h	U2-04	Output Frequency at Fault	Output Frequency at the time of current fault (0.0 to 400.0 Hz)		
084h	U2-05	Output Current at Fault	Output Current at the time of current fault (drive rating /8192)		
085h	U2-06	Motor Speed at Fault	Motor Speed at the time of current fault (in 0.1 Hz)		
086h	U2-07	Output Voltage at Fault	Output Voltage at the time of current fault (in 0.1 V)		
087h	U2-08	DC Bus Voltage at Fault	Output Voltage at the time of current fault (in 1 V)		
088h	U2-09	Output kWatts at Fault	Output Power at the time of current fault (in 0.1 kW)		
089h	U2-10	Torque Reference at Fault	Torque Reference at the time of current fault (in 0.1%)		
08Ah	U2-11	Input Terminal Status at Fault		0	Input Terminal 1 closed at time of fault
				1	Input Terminal 2 closed at time of fault
				2	Input Terminal 3 closed at time of fault
				3	Input Terminal 4 closed at time of fault
				4	Input Terminal 5 closed at time of fault
				5	Input Terminal 6 closed at time of fault
				6	Input Terminal 7 closed at time of fault
				7	Input Terminal 8 closed at time of fault
08Bh	U2-12	Output Terminal Status at Fault		0	Control Circuit terminals 9 & 10: “Closed”
				1	Control Circuit terminals 25 & 27: “Closed”
				2	Control Circuit terminals 26 & 27: “Closed”
				3-6	not used
				7	Control Circuit terminals 18 & 20: “Closed”

Notes:
(1) List of Drive Error Codes can be found in chapter 6, Error Codes and Troubleshooting.

Drive Parameter Registers (U2-xx / Fault Trace and U3-xx / Fault History) – Continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	BIT NO.	LIMITS / DESCRIPTION
08Ch	U2-13	Drive Status at Fault		0	Running at the time of fault
				1	Zero-Speed at the time of fault
				2	Reverse Running at the time of fault
				3	Reset Signal Input at the time of fault
				4	Speed Agree at the time of fault
				5	Drive Operation Ready at the time of fault
				6	Minor Fault
				7	Major Fault
08Dh	U2-14	Elapsed Time at Fault			Elapsed Time at the time of fault (in hrs.)
800h	U3-01	Last Fault			Code of the most recent fault **(1)**
801h	U3-02	Fault Message 2			Code of the second to most recent fault **(1)**
802h	U3-03	Fault Message 3			Code of the third to most recent fault **(1)**
803h	U3-04	Fault Message 4			Code of the fourth to most recent fault **(1)**
804h	U3-05	Elapsed Time 1			Elapsed Time at the most recent fault occurrence
805h	U3-06	Elapsed Time 2			Elapsed Time at the second to most recent fault occurrence
806h	U3-07	Elapsed Time 3			Elapsed Time at the third to most recent fault occurrence
807h	U3-08	Elapsed Time 4			Elapsed Time at the fourth to most recent fault occurrence
808h	U3-09	Fault Message 5			Code of the fifth to most recent fault **(1)**
809h	U3-10	Fault Message 6			Code of the sixth to most recent fault **(1)**
80Ah	U3-11	Fault Message 7			Code of the seventh to most recent fault **(1)**
80Bh	U3-12	Fault Message 8			Code of the eighth to most recent fault **(1)**
80Ch	U3-13	Fault Message 9			Code of the ninth to most recent fault **(1)**
80Dh	U3-14	Fault Message 10			Code of the tenth to most recent fault **(1)**
80Eh	U3-15	Elapsed Time 5			Elapsed Time at the fifth to most recent fault occurrence
80Fh	U3-16	Elapsed Time 6			Elapsed Time at the sixth to most recent fault occurrence
810h	U3-17	Elapsed Time 7			Elapsed Time at the seventh to most recent fault occurrence
811h	U3-18	Elapsed Time 8			Elapsed Time at the eighth to most recent fault occurrence
812h	U3-19	Elapsed Time 9			Elapsed Time at the ninth to most recent fault occurrence
813h	U3-20	Elapsed Time 10			Elapsed Time at the tenth to most recent fault occurrence
814h	U3-21	Accumulated Operations			Accumulated Operations
815h	U3-22	U3-21 Rollover			Increments each time U3-21 reaches 65535. U3-21 is set to 0
816h	U3-23	OL / LC Count			OverLoad / Load Check Count

Notes: (1) List of Drive Error Codes can be found in chapter 6, Error Codes and Troubleshooting.

Drive Parameter Registers (Read/Write)

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
100h	A1-00	Language Selection	0	English	0
			1	French	
			2	Spanish	
101h	A1-01	Parameter Access Level	0	Operation Only	2
			1	User Program	
			2	Advanced	
			3	Factory	
102h	A1-02	Control Method Selection	0	V/f Control	2
			1	V/f Control w/ PG (Factory Access Only)	
			2	Open Loop Vector	
			3	Flux Vector	
103h	A1-03	Motion Select	0	Traverse	1
			1	Standard Hoist	
			2	No-Load Brake Hoist	
			3	Bucket Hoist	
104h	A1-04	Speed Reference	0	2-Spd Multi-Step	6
			1	3-Spd Multi-Step	
			2	5-Spd Multi-Step	
			3	2-Step Infinitely Variable	
			4	3-Step Infinitely Variable	
			5	Uni-Polar Analog	
			6	Bi-Polar Analog	
			7	G5IN4 Option Card	
			8	Serial Opt Card	
105h	A1-05	Initialize Parameters	0000	No Initialize	0
			1110	User Initialize	
			2220	2-wire Initialize	
106h	A1-06	User Password 1	0000 ~ 9999		0
108h	A1-07	Factory Password 2	0000 ~ 9999		0
10Ah Through 129h	A2-01 ~ A2-32	User Selected Parameter 1 Through User Selected Parameter 32	Setting B1-01 ~ O4-02		0

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
180h	B1-01	Frequency Reference 1	0.00 to 400.00 Hz **(1)**		15.00
181h	B1-02	Frequency Reference 2	0.00 to 400.00 Hz **(1)**		30.00
182h	B1-03	Frequency Reference 3	0.00 to 400.00 Hz (**1)**		60.00
183h	B1-04	Frequency Reference 4	0.00 to 400.00 Hz **(1)**		45.00
184h	B1-05	Frequency Reference 5	0.00 to 400.00 Hz **(1)**		60.00
185h	B1-06	Frequency Reference 6	0.00 to 400.00 Hz **(1)**		0.00
186h	B1-07	Frequency Reference 7	0.00 to 400.00 Hz **(1)**		0.00
187h	B1-08	Frequency Reference 8	0.00 to 400.00 Hz **(1)**		0.00
188h	B1-09	Frequency Reference 9	0.00 to 400.00 Hz **(1)**		0.00
189h	B1-10	Frequency Reference 10	0.00 to 400.00 Hz **(1)**		0.00
18Ah	B1-11	Frequency Reference 11	0.00 to 400.00 Hz (**1)**		0.00
18Bh	B1-12	Frequency Reference 12	0.00 to 400.00 Hz **(1)**		0.00
18Ch	B1-13	Frequency Reference 13	0.00 to 400.00 Hz **(1)**		0.00
18Dh	B1-14	Frequency Reference 14	0.00 to 400.00 Hz **(1)**		0.00
18Eh	B1-15	Frequency Reference 15	0.00 to 400.00 Hz **(1)**		0.00
18Fh	B1-16	Frequency Reference 16	0.00 to 400.00 Hz **(1)**		0.00
190h	B1-17	Jog Frequency Reference	0.00 to 400.00 Hz **(1)**		6.00
191h	B1-18	Reference Priority[1]	0	Digital Reference Only	0
			1	Analog Reference Only	
			2	Higher Reference Select	
192h	B2-01	Frequency Reference Upper Limit	0.0 to 110.0%		100.0
193h	B2-02	Frequency Reference Lower Limit	0.0 to 110.0%		0.0
194h	B2-03	Master Speed Ref Lower Limit	0.0 to 110.0%		2
195h	B2-04	Alternate Upper Limit	0.0 to 110.0%		100
196h	B3-01	Reference Selection	0	Digital Operator	1
			1	Terminal	
			2	Serial Communication	
			3	Option PCB	
197h	B3-02	Operation Method Selection	0	Digital Operator	1
			1	Terminal	
			2	Serial Communication	
			3	Option PCB	

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
198h	B3-03	Stopping Method Selection	0	Ramp to Stop	Determined by A1-03 (Motion)
			1	Coast to Stop	
			2	DC Injection to Stop	
			3	Coast with Timer	
			4	Ramp with Timer	
			5	Hoist 2 Stop	
			6	No Load Brake	
29Ah	B3-04	Motor Rotation	0	Normal Rotation	0
			1	Exchange Phases	
199h	B3-05	Zero Speed Operation (level determined by E1-09)	0	Run at Frequency Reference	0
			1	Stop	
			2	Run at Min. Frequency (E1-09)	
			3	Run at Zero Speed	
19Ah	B3-06	Logic Input Scan Rate	0	2ms - 2 scans	1
			1	5ms - 2 scans	
19Bh	B3-07	Local / Remote RUN Selection	0	Cycle External Run	0
			1	Accept External Run	
19Ch	B3-08	Run Command Selection @ Program Mode	0	Disabled	0
			1	Enabled	
19Eh	B3-10	Allow Run @ Power Up	0	Disabled	0
			1	Enabled	
19Fh	B4-01	Frequency refgerence Hold Function	0	Disabled: Operates at Zero when restarting	0
			1	Enabled: Operates at previously hel frequency	
1A0h	B4-02	Trim Control Level	0 to 100%		10
1A1h	B5-01	Acceleration Time 1	0.0 to 25.5 seconds		5.0
1A2h	B5-02	Deceleration Time 1	0.0 to 25.5 seconds		3.0
1A3h	B5-03	Acceleration Time 2	0.0 to 6000.0 seconds		2.0
1A4h	B5-04	Deceleration Time 2	0.0 to 6000.0 seconds		2.0
1A5h	B5-05	Acceleration Time N Chg	0.0 to 25.5 seconds		2.0
1A6h	B5-06	Deceleration Time N Chg	0.0 to 25.5 seconds		2.0
1A8h	B5-08	Fast Stop Time	0.0 to 25.5 seconds		0.5
1A9h	B5-09	Accel / Decel Time Setting Unit	0	0.01 seconds	1
			1	0.1 seconds	
1AAh	B5-10	Accel / Decel Time Switching Freq.	0.0 to 400.0 Hz		60.00

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
1ACh	B5-12	Acceleration Time 3	0.0 to 6000.0 seconds		3.0
1ADh	B5-13	Deceleration Time 3	0.0 to 6000.0 seconds		3.0
1AEh	B5-14	Acceleration Time 4	0.0 to 6000.0 seconds		3.0
1AFh	B5-15	Deceleration Time 4	0.0 to 6000.0 seconds		3.0
1B0h	B6-01	Speed Search @ Start	0	Disabled	2
			1	Enabled: Speed Estimation Type	
			2	Disabled	
			3	Enabled: Current Detection Type	
1B1h	B6-02	Speed Search Operation Current	0.0 to 200.0%		120
1B2h	B6-03	Speed Search Deceleration Time	0.1 to 10.0 seconds		2.0
1B4h	B6-05	Search Delay Time	0.0 to 20.0 seconds		0.2
1B9h	B6-10	Speed Detect Comp Gain	1.00 to 1.50		1.10
29Dh	B6-14	Bidirectional Search	0	Disabled: Drive uses frequency reference det	1
			1	Enabled: Drive uses detected direction	
1BCh	B8-01	Jump Frequency 1	0.0 to 400.0 Hz		0.0
1BDh	B8-02	Jump Frequency 2	0.0 to 400.0 Hz		0.0
1BEh	B8-03	Jump Frequency 3	0.0 to 400.0 Hz		0.0
1BFh	B8-04	Jump Bandwitdh	0.0 to 20.0 Hz		1.0
1C4h	C1-01	Quick Stop 0/1	0	Disabled	0
			1	Enabled	
1C5h	C1-02	Quick Stop Time	0.0 to 25.5 seconds		1.0
1C6h	C1-03	Plug Reverse 0/1	0	Disabled	0
			1	Enabled	
1C7h	C1-04	Plug Reverse Decel Time	0.0 to 25.5 seconds		2.0
1C8h	C1-05	Plug Reverse Accel Time	0.0 to 25.5 seconds		2.0
1C9h	C2-01	Micro Speed Gain 1	0.00 to 2.55		1.0
1CAh	C2-02	Micro Speed Gain 2	0.00 to 2.55		1.0
1CBh	C3-01	Upper Limit 1 Speed	0.00 to 400.00 Hz		6.00
1CCh	C3-02	Upper Limit 1 Decel Time	0.0 to 25.5 sec		1.0
1CDh	C3-03	Upper Limit 2 Stop Time	0.0 to 25.5 sec		0.5
1CEh	C3-04	Lower Limit 1 Speed	0.00 to 400.00 Hz		6.00
1CFh	C3-05	Lower Limit 1 Decel Time	0.0 to 25.5 sec		1.0

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
1D0h	C3-06	Lower Limit 2 Stop Time	0.0 to 25.5 sec		1.0
1D1h	C3-07	Limit Stop Method	0	Decel to Stop	2
			1	BB to Stop	
			2	Use B3-03 Method	
1D2h	C3-08	UL3 Stop Method	0	Decel/Alarm(No further raise allowed)	4
			1	Coast/Alarm (No further raise allowed)	
			2	Use B3-03/Alarm (No further raise allowed)	
			3	Decel/Fault	
			4	Coast/Fault	
			5	Use B3-03/Fault	
1D3h	C3-09	Phantom Stop Met	0	Decel To stop	1
			1	Coast to Stop	
			2	Use B3-03 Method	
600h	C3-10	Load Share Limit	0	Disabled	0
			1	Enabled	
1D4h	C4-01	Load Float Time 2	0 to 255 Sec		10
1D5h	C4-02	Load Float Gain	0 to 100		10/20
1D6h	C4-03	Load Float Count	0 to 16383		10
1D7h	C5-01	Load Check 0 / 1	0	Disabled	0
			1	Enabled	
1D8h	C5-02	Load Check Alarm Action	0	Alarm Only	1
			1	Decel to Stop	
			2	Coast to Stop	
			3	Fault Stop	
			4	Use B3-03 Method – Can lower only (Alarm)	
1D9h	C5-03	Minimum Torque Reference	0 to 100%		60
1DAh	C5-04	Look Speed 1	0 to 400 Hz		6
1DBh	C5-05	I Ref for LS 1 (V/F or OLV)	1 to 300 % IRC		160
1DDh	C5-07	Look Speed 2	0 to 400 Hz		20
1DEh	C5-08	I Ref for LS 2 (V/F or OLV)	1 to 300 % IRC		160
1DFh	C5-09	Look Speed 3	0 to 400 Hz		40
1E0h	C5-10	I Ref for LS 3 (V/F or OLV)	1 to 300 % IRC		160
1E1h	C5-11	I Ref for > LS 3	1 to 300 %		160
1E2h	C5-12	Load Check Setting Time	0.00 to 2.55 sec		1.00

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
1E3h	C5-13	Load Check Test Time	0.00 to 2.55 sec	0.25	
1E4h	C5-14	Load Check Alarm Speed	0.0 to 30.0 Hz	6.0	
1E5h	C6-01	Ultra / Swift Lift 0 / 1	0	Diabled	0
			1	Enabled Automatic	
			2	Enabled by MFI	
1E6h	C6-02	Ultra / Swift Lift Forward Speed	0 to 400 Hz		60
1E7h	C6-03	Ultra / Swift Lift Reverse Speed	0 to 400 Hz		60
1E8h	C6-04	Ultra / Swift Lift Forward Torque	0 to 100 %		50
1E9h	C6-05	Ultra / Swift Lift Rerverse Torque	0 to 100 %		30
1EAh	C6-06	Ultra / Swift Lift Enabling Speed	0.0 to 400.0 Hz		59.0
1EBh	C6-07	Ultra / Swift Lift Delay Time	0.0 to 25.5 sec		2.0
1ECh	C6-08	SFS Acc Gain	0.1 to 9.9		1.0
286h	C6-09	Normal OS Level	40.0 to 400.0 Hz		60.0
1EDh	C7-01	Forward Torque Limit	0 to 300%		150
1EEh	C7-02	Reverse Torque Limit	0 to 300%		150
1EFh	C7-03	Forward Regenerative Torque Limit	0 to 300%		180
1F0h	C7-04	Reverse Regenerative Torque Limit	0 to 300%		180
1F1h	C7-05	Torque Limit Gain MFI	0 to 2.55		1.25
1F3h	C8-01	Torque Compensation Time	0.00 to 2.55 Sec		1.00 / 2.00
1F4h	C8-02	IFB OK Time	0.00 to 2.55 Sec		1.00 / 2.00
1F5h	C8-03	Minimum Brake Release Torque	0 to 300 %		10/100
1F6h	C8-04	Roll Back Timer / BE4 Timer	0.00 to 2.55 Sec		0.30
1F7h	C8-05	Roll Back Count	0 to 16536 Pulses		800
1F8h	C8-06	BE3 / Alternate Torque Timer	0.00 to 2.55 Sec		0.30
1F9h	C8-07	BE3 Detection Count	0 to 16536 Pulses		25
1FAh	C8-08	Alternate Reverse Torque Limit	0 to 300 %		25
1FBh	C8-09	Zero Speed Level	0.0 to 10.0 Hz		1
1FCh	C8-10	Load Float Time	0 to 255 Sec		10
IFDh	C8-11	Brake Set Delay Time	0.00 to 25.5 Sec		0.7
1FEh	C8-12	BE6 Detect Timer	0.00 to 25.5 Sec		5.0
1FFh	C8-13	BE6 Max Count	0 to 16536 Pulses		250
200h	C8-14	Brake Hold Speed	B2-02 + 0.1 to 25.5 %		5.0
201h	C8-15	Load Float Extention timer	0 to 255 Sec		10

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING		LIMITS / DESCRIPTION
202h	C8-16	Initial Brake Release Torque	0 to 300 %		100
203h	C8-17	BE6 Up Speed Limit	0.00 to 400.00 Hz		6.00
205h	C8-19	Brake Test Torque	0 to 300%		125
206h	C8-20	Brake Test Speed	0 to 10Hz		6
207h	C8-21	Height Measure	0 to 65535		250
601h	C8-22	Brake Slip Detect	0	Disabled	0
			1	Enabled	
602h	C8-23	Brake Slip Detect Speed	0.0 to 10.0 Hz		1.0
208h	C9-01	G5IN4 Option Enable	0	Disabled	0
			1	Enabled	
209h	C9-02	G5IN4 Option Setup	0000 to FFFF		0
20Ah	C10-01	Load Weight 0 / 1	0	Disabled	0
			1	Enabled at C5-04	
			2	Enabled by MFI	
			3	Both Auto & MFI	
			4	Analog Input (Load Cell) Data “16”	
20Bh	C10-02	Torque Primary Delay	0 to 1000 ms		200
20Ch	C10-03	Load Weight Display	0	Hold Display	0
			1	Hold Display for 3 Seconds	
20Dh	C10-04	Load Weight Conversion	00000 to 39999		0
20Eh	C10-05	Full Load Torque	0.0 to 200.0 %		100.0
20Fh	C10-06	No Load Torque	0.0 to 200.0 %		20.0
210h	C10-07	Unit Displayed	0	Tons	0
			1	Pounds	
			2	Kilograms	
			3	Metric Tons	
			4	Percent load	
211h	C10-08	Weight Limit Output	0.0 to 200.0%		125.0%
212h	C11-01	Slack Cable 0 / 1	0	Disabled	0
			1	Enabled	

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
213h	C11-02	Action at Slack Cable	0	No Action	2
			1	No Action / C3-04	
			2	Decel / C3-04	
			3	Decel / No Operation	
			4	Decel to Stop / C3-04	
			5	Decel to Stop / No Operation	
214h	C11-03	Slack Cable Detect Torque	0 to 100 %		30
215h	C11-04	Slack Cable Detect Speed 1	0 to 150 Hz		2
216h	C11-05	Slack Cable Delay Time 1	0.00 to 2.55 Sec		0.50
217h	C11-06	Slack Cable Detect Speed 2	0 to 150 Hz		60
218h	C11-07	Slack Cable Delay Time 2	0.00 to 2.55 Sec		0.10
219H	C11-08	Snap Shaft Detection	0	Disabled	0
			1	Enabled	
21Ah	C11-09	Drive Train Discontinu (Action @ Snap Shaft)	0	Brake / Fault Out	0
			1	Alarm Only	
21Bh	C11-10	SS Delta Speed	0.0 to 400.0 Hz		1.0
21Ch	C11-11	SS Delay Time	0 to 2000 mSec		250
21Dh	C11-12	Gear Ratio Numerator	1 to 65535		10000
21Eh	C11-13	Gear Ratio Denominator	1 to 65535		10000
21Fh	C12-01	Brake Jog Delay	0.0 to 100.0 Sec		0.0
220h	C12-02	Brake Run Delay	0.0 to 100.0 Sec		0.0
221h	C12-03	Delay-ON Timer	0.0 to 3000.0 Sec		0.0
222h	C12-04	Delay-OFF Timer	0.0 to 3000 Sec		0.0
223h	C12-05	Maintenance Timer	0 to 32767 Hour		0
224h	C12-06	Maintenance Gain	0.00 to 1.00		0.50
225h	C13-01	Inch Run Time	0.00 to 2.55 Sec		1.00
226h	C13-02	Inch Repeat Delay Time	0.00 to 2.55 Sec		1.00
227h	C13-03	Index Run Reference	0.01 to 60.00 Hz		0.10
228h	C13-04	Index Revolutions	0 to 65535 Revs		0
229h	C13-05	Index Count	0 to 65535 PLS		100
22Ah	C13-06	Index Repeat Delay	0.00 to 60.00 Sec		0.00
22Bh	C13-07	Index Complete	0 to 32767		10
288h	C13-08	Index Zero Servo Gain	0 to 100		10

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
289h	C13-09	Index ASR P Gain	0.00 to 300.00		30.00
28Ah	C13-10	Index ASR I Time	0.000 to 10.000 Sec		0.20
28Bh	C13-11	Index Gain	0.0 to 20.0		5.0
23Bh	D1-01	DC Injection Start Frequency	0.0 to 10.0 Hz		0.5
23Ch	D1-02	DC Injection Current	0 - 100%		50
23Dh	D1-03	DC Injection Time at Start	0.00 - 10.00 seconds		0.00
23Eh	D1-04	DC Injection Time at Stop	0.00 - 10.00 seconds		0.05
243h	D2-01	Slip Compensation Gain	0.0 to 2.5		0.0 / 1.0
244h	D2-02	Slip Comp Primary Delay Time	0 to 10000 msec.		200 / 2000
245h	D2-03	Slip Compensation Limit	0 to 250%		200
246h	D2-04	Slip Compensation Selection during Regeneration	0	Disabled	0
			1	Enabled	
247h	D2-05	V/f Slip Comp Select	0	Disabled	0
			1	Enabled	
248h	D2-06	Output V Limit Select	0	Magnetek Flux is calculated by output frequency after compensation	0
			1	Magnetek Flux is calculated by output frequency before compensation	
249h	D3-01	Torque Compensation Gain	0.00 to 2.50		1.00
24Ah	D3-02	Torque Compensation Time	0.00 to 10000 ms		20 / 200
24Bh	D3-03	Torque Compensation for Forward	0.0 to 200.0%		0.0
24Ch	D3-04	Torque Compensation for Reverse	-200.0 to 0.0%		0.0
24Dh	D3-05	Torque Compensation Time Const @ Start	0 to 200 ms		10
24Fh	D4-01	ASR Proportional Gain 1	0.00 to 300.00		30.00 / 0.30
250h	D4-02	ASR Integral Time 1	0.000 to 10.000 seconds		0.500 / 0.20
251h	D4-03	ASR Proportional Gain 2	0.00 to 300.00		30.00
252h	D4-04	ASR Integral Time 2	0.000 to 10.000 seconds		0.100 / 0.050
253h	D4-05	ASR Limit	0.0 to 20.0%		5.0
254h	D4-06	ASR Primary Delay Time	0.000 TO 0.500 seconds		0.004
255h	D4-07	ASR Gain Switching Frequency	0.0 to 400.0 Hz		0.0
256h	D4-08	ASR Integral Limit	0 to 400 %		400
257h	D5-01	Torque Control	0	Speed Control (Controlled by D4-01 ~ 07)	0
			1	Torque Control	

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
258h	D5-02	Torque Ref Filter	0 to 1000 ms		0
259h	D5-03	Speed Limit Select	1	Limited by Frequency Reference (B3-01)	2
			2	Programming Setting (D5-04)	
25Ah	D5-04	Speed Limit Value	-120 to +120%		100
25Bh	D5-05	Speed Limit Bias	0 to 120%		0
25Ch	D5-06	Ref Hold Time	0 to 1000 ms		0
25Dh	D6-01	Droop Control Gain	0.0 to 100.0 ms		0.0
25Eh	D6-02	Droop Control Delay Time	0.03 to 2.00 seconds		0.05
270h	D8-01	Dwell Frequency at Start	0.0 to 400.0 Hz		0.0
271h	D8-02	Dwell Time at Start	0.0 to 10.0 seconds		0.0
272h	D8-03	Dwell Frequency at Stop	0.0 to 400.0 Hz		0.0
273h	D8-04	Dwell Time at Stop	0.0 to 10.0 seconds		0.0
274h	D9-01	S-curve Characteristic at Accel Start	0.0 to 2.50 seconds		0.20
275h	D9-02	S-curve Characteristic at Accel End	0.0 to 2.50 seconds		0.20
276h	D9-03	S-curve Characteristic at Decel Start	0.0 to 2.50 seconds		0.20
277h	D9-04	S-curve Characteristic at Decel End	0.0 to 2.50 seconds		0.20
282h	D11-01	Hunting Prevention Select	0	Disabled	1
			1	Enabled	
283h	D11-02	Hunting Prevention Gain	0.00 to 2.50		1.00

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
300h	E1-01	Input Voltage Setting	155 to 255V (230V unit) 310 to 510V (460V unit)		230 460
302h	E1-03	V/f Pattern Selection	0 to E	15 preset V/f patterns	**(1)**
			F	Custom Pattern (using E1-04 to E1-10)	
303h	E1-04	Maximum Output Frequency	40.0 to 300.0 Hz **CT** 40.0 to 400.0 Hz **VT**		60.0
304h	E1-05	Maximum Voltage	0.0 to 255.0V (230V unit) 0.0 to 510.0V (460V unit)		230.0 460.0
305h	E1-06	Base Frequency	0.0 to 400.0 Hz		60.0
306h	E1-07	Mid. Output Frequency A	0.0 to 400.0 Hz		**(1)**
307h	E1-08	Mid Output Voltage A	0.0 to 255.0V (230V unit) 0.0 to 510.0V (460V unit)		**(1)**
308h	E1-09	Min. Output Frequency	0.0 to 400.0 Hz		**(1)**
309h	E1-10	Min. Output Voltage	0.0 to 255.0V (230V unit) 0.0 to 510.0V (460V unit)		**(1)**
30Ah	E1-11	Mid Frequency B	0.0 to 400.0 Hz		0.0
30Bh	E1-12	Mid Voltage B	0.0 to 255.0 VAC		0.0
30Ch	E1-13	Base Voltage	0.0 to 255.0 VAC		0.0
30Dh		Reserved			
30Eh	E2-01	Motor Rated Current	0.32 to 6.40 A		**(2)**
30Fh	E2-02	Motor Rated Slip	0.00 to 20.00 Hz		**(2)**
310h	E2-03	Motor No-Load Current	0.00 to 1.89 Amps		**(2)**
311h	E2-04	Number of Motor Poles	2 to 48 poles		4
312h	E2-05	Motor Terminal Resistance	0.000 to 65.000 Ohms		**(2)**
313h	E2-06	Motor Leakage Inductance	0.0 to 40.0%		**(2)**
314h	E2-07	Motor Iron-core Saturation Coefficient 1	0.00 to 0.50		.50
315h	E2-08	Motor Iron-core Saturation Coefficient 2	E2-07 to 0.75		0.75
316h	E2-09	Motor Mechanical Loss	0.0 to 10.0%		0.0

Notes (for this page only):

(1) Initial Value differs depending on the control method (A1-02).

(2) Values differs depending on the drive capacity.

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
317h	E2-10	Tcomp Iron Loss	0 ~ 65535 W		(1)
318h	E2-11	Rated Horsepower	0.00 ~ 650.00		(1)
380h	F1-01	Encoder (PG) Constant	0 to 60000 ppr		1024
381h	F1-02	Operation Selection at PG Open Circuit	0	Ramp to stop	1
			1	Coast to stop	
			2	Fast-stop	
			3	Alarm only	
382h	F1-03	Operation Selection at Overspeed	0	Ramp to stop	1
			1	Coast to stop	
			2	Fast-stop	
			3	Alarm only	
383h	F1-04	Operation Selection at Speed Deviation	0	@Speed Agree-Ramp to stop(B5-02)	1
			1	@Speed Agree-Coast to stop	
			2	@Speed Agree_Fast-stop(B5-08)	
			3	@Speed Agree-Alarm only	
			4	@Run-Decel(B5-02)	
			5	@Run-Coast to Stop	
			6	@Run-Fast Stop(B5-08)	
			7	@Run-Alarm Only	
384h	F1-05	PG Rotation	0	FWD:Counter-clockwise	0
			1	FWD:Clockwise	
385h	F1-06	PG Division Rate (PG Pulse Monitor)	1 to 132 (effective only with PG-B2 control board)		1
386h	F1-07	Integral Value during Accel/Decel Selection	0	Disabled	0
			1	Enabled	
387h	F1-08	Overspeed Detection Level	0 to 120%		115
388h	F1-09	Overspeed Detection Delay Time	0.0 to 2.0 seconds		0.0
389h	F1-10	Excessive Speed Deviation Detection Level	0 to 50%		10
38Ah	F1-11	Excessive Speed Deviation Detection Delay Time	0.0 to 10.0 seconds		0.3

Notes (for this page only):

(1) Initial Value differs depending on the control method (A1-02).

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
38Bh	F1-12	Number of PG Gear Teeth 1	0 to 1000		0
38Ch	F1-13	Number of PG Gear Teeth 2	0 to 1000		0
38Dh	F1-14	PG-O Ch1 Software Detection Time	0 ~ 10.0 Sec		0.5
38Fh	F1-16	PG CH2 PPR	1 to 60000 PPR		1024
390h	F1-17	PG CH2 Rotation	0	0: FWD = C.C.W	0
			1	1: FWD = C.W.	
391h	F1-18	PG-O Ch2 Software Detection Time	0 ~ 10 Sec		0.5
392h	F1-19	PG-Z2 Output Select	0	Select by MFI 41 (Motor 2 Select)	2
			1	Channel 1	
			2	Channel 2	
			3	Select by MFI 64	
393h	F1-20	PGO-1-H	0	Disabled	1
			1	Enabled	
394h	F1-21	PGO-2-H	0	Disabled	0
			1	Enabled	
395h	F1-22	PG-Z2 Input Sel	0	Motor 1 = CH1 (Motor 2 = CH2)	0
			1	Motor 1 = CH2 (Motor 2 = CH1)	
396h	F2-01	AI-14 Bi-polar or Uni-polar Input Selection	0	3-channel Individual	0
			1	3-channel Addition	
397h	F3-01	DI-16 Digital Input Option	0	BCD 1%	0
			1	BCD 0.1%	
			2	BCD 0.01%	
			3	BCD 1 Hz	
			4	BCD 0.1 Hz	
			5	BCD 0.01 Hz	
			6	BCD (5DG) 0.01 Hz	
			7	Binary	
398h	F4-01	AO-08/AO-12 Channel 1 Monitor Select.	1 to 50		2
399h	F4-02	AO-08/AO-12 Channel 1 Gain	0.00 to 1000.0%		100.0
39Ah	F4-03	AO-08/AO-12 Channel 2 Monitor Select.	1 to 50		3
39Bh	F4-04	AO-08/AO-12 Channel 2 Gain	0.00 to 1000.0%		100.0
39Ch	F4-05	CH1 AO Bias	-110.0 ~ 110.0%		0.0

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
39Dh	F4-06	CH2 AO Bias	-110.0 ~ 110.0%		0.0
39Eh	F4-07	Analog Output Signal Level CH1	0	0 ~ 10VDC	0
			1	-10 ~ +10VDC	
39Fh	F4-08	Analog Output Signal Level CH2	0	0 ~ 10VDC	0
3A0h	F5-01	DO-02 Channel 1 Output Selection	00 to FF		F
3A1h	F5-02	DO-02 Channel 2 Output Selection	00 to FF		F
3A2h	F5-03	DO-02 Channel 3 Output Selection	00 to FF		F
3A3h	F5-04	DO-02 Channel 4 Output Selection	00 to FF		F
3A4h	F5-05	DO-02 Channel 5 Output Selection	00 to FF		F
3A5h	F5-06	DO-02 Channel 6 Output Selection	00 to FF		F
3A6h	F5-07	DO-02 Channel 7 Output Selection	00 to FF		F
3A7h	F5-08	DO-02 Channel 8 Output Selection	00 to FF		F
3A8h	F5-09	DO-08 Output Mode Selection	0	8-channel Individual	0
			1	Binary Output	
			2	8CH Sel–Outputs according to F5-01 ~ 08	
			3	Serial Com Output – Serial Communication	
3A9h	F6-01	Communication Error Detection Operation Selection	0	Deceleration To Stop (B5-02)	1
			1	Coast To Stop	
			2	Fast Stop (B5-08)	
			3	Use B3-03 Method	
			4	Alarm Only (Operation Continues)	
3AAh	F6-02	EFO Detection	0	Always Detected	0
			1	Detected Only During Run	

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
3ABh	F6-03	EFO Fault Action	0	Deceleration To Stop (B5-02)	1
			1	Coast To Stop	
			2	Fast Stop (B5-08)	
			3	Use B3-03 Method	
			4	Alarm Only (Operation Continues)	
3ADh	F6-05	Current Monitor Display Unit Selection	0	Amp Display	0
			1	100%/8192	
3AEh	F6-06	Torque Reference/Torque Limit	0	Disabled-Torque Ref/Limit From Communication is Disabled	0
			1	Enabled – Torque Reference/Limit From Communication is Enabled	
400h	H1-01	Multi-function Input (terminal 3)	0 to 6Dh		0
401h	H1-02	Multi-function Input (terminal 4)	0 to 6D h		1
402h	H1-03	Multi-function Input (terminal 5)	0 to 6D h		F
403h	H1-04	Multi-function Input (terminal 6)	0 to 6D h		F
404h	H1-05	Multi-function Input (terminal 7)	0 to 6D h		F
405h	H1-06	Multi-function Input (terminal 8)	0 to 6D h		F
40Bh	H2-01	Multi-function Output (term. M1 - M2)	0 to FF h		0
40Ch	H2-02	Multi-function Output (term. M3 – M4)	0 to FF h		0
40Dh	H2-03	Multi-function Output (term. M5 – M6)	0 to FFh		7F
410h	H3-01	Terminal A1 Signal Voltage	0	0 to 10 V DC	0
			1	-10 to +10 V DC	
411h	H3-02	Terminal A1 Gain	0.0 to 1000.0%		100.0
412h	H3-03	Terminal A1 Signal Bias	-100.0 to +100.0%		0.0
413h	H3-04	Terminal A3 Signal Voltage	0	0 to 10 V DC	0
			1	-10 to +10 V DC	
414h	H3-05	Multi-function Analog Input Term A3 Select	0 to 1F		1F
415h	H3-06	Multi-function Analog Input Term A3 Gain	0.0 to 1000.0%		100.0
416h	H3-07	Multi-function Analog Input Term A3 Bias	-100.0 to +100.0%		0.0
417h	H3-08	Terminal A2 Signal Voltage	0	0 to 10 V DC	2
			1	-10 to +10 V DC	
			2	4 to 20 mA	
418h	H3-09	Multi-function Analog Input Term A2 Select	1 to 1F		0

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
419h	H3-10	Multi-function Analog Input Term A2 Gain	0.0 to 1000.0%		100.0
41Ah	H3-11	Multi-function Analog Input Term A2 Bias	-100.0 to +100.0%		0.0
41Bh	H3-12	Analog Input Filter Time Constant	0.00 to 2.00 seconds		0.00
41Dh	H4-01	Multi-function Analog Output 1 Selection (Terminal FM)	1 to 67H		2
41Eh	H4-02	Multi-function Analog Output 1 Gain	0.00 to 1000.0%		100.0
41Fh	H4-03	Multi-function Analog Output 1 Bias	-110.0 to +110.0%		0.0
420h	H4-04	Multi-function Analog Output 2 Selection (Terminal AM)	1 to 67H		3
421h	H4-05	Multi-function Analog Output 2 Gain	0.00 to 1000.0%		50.0
422h	H4-06	Multi-function Analog Output 2 Bias	-110.0 to +110.0%		0.0
423h	H4-07	Multi-function Analog Output 1 Signal Level Selection (Terminal FM)	0	0 to 10 V DC	0
			1	-10 to +10 V DC	
			2	4 to 20 mA	
424h	H4-08	Multi-function Analog Output 2 Signal Level Selection (Terminal AM)	0	0 to 10 V DC	0
			1	-10 to +10 V DC	
			2	4 to 20 mA	
425h	H5-01	Serial Communication Address	0 to 20H		1F
426h	H5-02	Serial Communication Baud Rate	0	1200 bps	3
			1	2400 bps	
			2	4800 bps	
			3	9600 bps	
			4	19200 bps	
427h	H5-03	Serial Communication Parity Selection	0	No Parity	0
			1	Even Parity	
			2	Odd Parity	
428h	H5-04	Stopping Method after Serial Communication Error	0	Ramp to Stop	1
			1	Coast to Stop	
			2	Fast-Stop	
			3	Alarm Only	
429h	H5-05	Communication Error (CE) Detection Selection	0	Disabled	1
			1	Enabled	

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
42Ah	H5-06	Send Waiting Time	5 ~ 65 mSec		5
42Bh	H5-07	RTS Control Select	0	Disabled (RTS is always on)	1
			1	Enabled (RTS is on only when sending)	
42Ch	H6-01	Pulse Input Function Select	0	Frequency Reference (B3-01)	0
			1	PID Feedback	
			2	PID Set Point	
42Dh	H6-02	Pulse Input Scaling	1000 ~ 32000 Hz		1440
42Eh	H6-03	Pulse Input Gain	0.0 ~ 1000.0%		100.0
42Fh	H6-04	Pulse Input Bias	-100.0 ~ 110.0%		0.0
430h	H6-05	Pulse Input Filter Time	0.00 ~ 2.00 Sec		0.10
431h	H6-06	Pulse Output Selection	1,2,5,20,24		2
432h	H6-07	Pulse Output Scaling	0 ~ 32000 Hz		1440
480h	L1-01	Motor Overload Protection Selection	0	Disabled	3
			1	Std Fan Cooled	
			2	Std Blower Cooled	
			3	Vector Motor	
481h	L1-02	Motor Overload Protection Time Constant	0.1 to 20.0 Minutes		8.0
482h	L1-03	Motor Overheat Alarm Operation Selection	0	Alarm: Decel to Stop	3
			1	Alarm: Coast To Stop	
			2	Alarm: Fast-Stop (B5-08)	
			3	Alarm: Alarm Only OH3 Flashes on D.O,	
			4	Alarm: Stop by B3-03 Method	
483h	L1-04	Motor Overheat Operation Selection	0	Decel To Stop	2
			1	Coast To Stop	
			2	Fast Stop by B5-08 Deceleration Time	
484h	L1-05	Motor Temp Input Filter Time Constant	0.00 ~ 10.00 Sec		0.20
485h	L2-01	Momentary Power Loss Detection	0	Disabled	0
			1	Powerloss Ride Thru Time	
			2	While CPU Power Active	
486h	L2-02	Momentary Powerloss Ride Through Time	0.0 ~ 25.5 Sec		(1)

Notes (for this page only):

(1) Initial Value differs depending on the drive capacity(O2-04)

Drive Parameter Registers (Read/Write) – continued

487h	L2-03	Minimum Base Block Time	0.1 ~ 5.0 Seconds		(1)
488h	L2-04	Pwrl V/F Ramp Time	0.0 ~ 5.0 Seconds		0.3
489h	L2-05	Undervoltage Detection Level	230VAC: 150 ~ 210 VDC 460VAC: 300 ~ 410 VDC		190 380
48Fh	L3-01	Stall Prevention Selection during Acceleration	0	Disabled	1
			1	General-purpose	
			2	Intelligent **(2)**	
490h	L3-02	Stall Prevention Level during Accel	0 to 200%		150 (1)
491h	L3-03	Stall Prevention Level during Accel (CHP)	0 to 100%		50
492h	L3-04	Stall Prevention Selection during Deceleration	0	Disabled	0
			1	General-purpose	
			2	Intelligent **(2)**	
			3	Stall Prevent with Braking Resistor	
493h	L3-05	Stall Prevention Selection during Running	0	Disabled	1
			1	Decel time 1	
			2	Decel time 2	
494h	L3-06	Stall Prevention Level during Running	30 to 200%		150(1)
499h	L4-01	Speed Agree 1 Level	0.0 ~ 300.0 CT 0.0 ~ 400.0 VT		0.0
49Ah	L4-02	Speed Agree 1 Width	0.0 to 20.0 Hz		2.0
49Bh	L4-03	Speed Agree 2 Level (+/-)	-400.0 to +400.0 Hz		0.0
49Ch	L4-04	Speed Agree 2 Width	0.0 to 20.0 Hz		2.0
48Eh	L4-05	Frequency Reference Loss Detection	0	Stop	0
			1	Run at 80% of Frequency Reference	

Notes (for this page only):

(1) Initial value differs depending on drive capacity.

(2) When Vector Control (A1-02 = 2 or 3) is selected, set value 2 (intelligent) cannot be used.

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
4A1h	L6-01	Torque Detection Selection 1	0	Disabled	0
			1	Alarm: OT @ Spd Agree	
			2	Alarm: OT @ Run	
			3	Fault: OT @ Spd Agree	
			4	Fault: OT @ Run	
			5	Alarm: UT @ Spd Agree	
			6	Alarm: UT @ Run	
			7	Fault: UT @ Spd Agree	
			8	Fault: UT @ Run	
4A2h	L6-02	Torque Detection Level 1	0 to 300%		150
4A3h	L6-03	Torque Detection Time 1	0.0 to 10.0 seconds		0.1
4A4h	L6-04	Torque Detection Selection 2	0	Disabled	0
			1	Alarm: OT @ Spd Agree	
			2	Alarm: OT @ Run	
			3	Fault: OT @ Spd Agree	
			4	Fault: OT @ Run	
			5	Alarm: UT @ Spd Agree	
			6	Alarm: UT @ Run	
			7	Fault: UT @ Spd Agree	
			8	Fault: UT @ Run	
4A5h	L6-05	Torque Detection Level 2	0 to 300%		150
4A6h	L6-06	Torque Detection Time 2	0.0 to 10.0 seconds		0.1
4AEh	L8-02	oH (Overheat) Protection Alarm LvL	50 to 110 ^{o}C		95 (1)
4AFh	L8-03	Operation Selection after oH (Overheat) Pre-alarm	0	Ramp to Stop	3
			1	Coast to Stop	
			2	Fast-stop	
			3	Alarm Only	

Notes (for this page only):

(1) Initial value differs depending on drive capacity.

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
4B1h	L8-05	Input Phase Loss Protection	O	Disabled	1
			1	Enabled	
4B3h	L8-07	Output Phase Loss Protection	0	Disabled	2
			1	Enabled: 1 PH Loss Det	
			2	Enabled: 2/3 Loss Det	
4B5h	L8-09	Ground Fault Detection	0	Disabled	1
			1	Enabled	
4B6h	L8-10	Cooling Fan Operation Select	0	Fan On-Run Mode	0
			1	Fan Always On	
4B7h	L8-11	Coolinf Fan On/Off Delay Time	0 ~ 300 Seconds		60
4B8h	L8-12	Ambient Temperature	45 ~ 60 Deg C		45
4BBh	L8-15	OL2 Select @ Low Speed	0	Disabled: OL Disabled @ Low Speed	1 (1)
			1	Enabled	
4BEh	L8-18	Soft CLA Selection	0	Disabled	0
			1	Enabled	
4BFh	L9-01	Auto Restart Operation Selection	0	Disabled	1
			1	Enabled	
4C0h	L9-02	Number of Auto Restart Attempts	0 to 10		3
4C1h	L9-03	Reset Time	0.0 to 180.0 Seconds		0.5
4C2h	L9-04	Reset Fault Select 1	0000 to FFFF		0001
4C3h	L9-05	Reset Fault Select 2	0000 to FFFF		E000
4C4h	L9-06	Fault Contact Select	0	Disabled: Fault Contact Not Operated	0
			1	Enabled: Fault Contact is Operated	
584h	N2-01	AFR Gain	0.00 ~ 10.00		1.00
585h	N2-02	AFR Time	0 ~ 2000 mSeconds		50
586h	N2-03	AFR Time 2	0 ~ 2000 mSeconds		750
587h	N2-04	AFR Limit	0.0 ~ 60.0 Hz		5.0
500h	O1-01	Monitor Selection	4 to 52		6

Notes (for this page only):

(1) Setting depends on D10-01. When D10-01 = 0, L8-15 will change to 0. When D10-01 = 1 or 2, it will change to 1

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
501h	O1-02	Monitor Selection after Power-up	1	Frequency Reference	1
			2	Output Frequency	
			3	Output Current	
			4	Monitor item Set by O1-01	
502h	O1-03	Digital Operator Display Scaling	0 ~ 39999		0
503h	O1-04	Digital Operator Display Units	0	Hz	0
			1	RPM	
504h	O1-05	LCD Brightness Adjust	0 ~ 5		3
505h	O2-01	Mode Service Key Select	0	Mode/Service	0
			1	Local/Remote	
506h	O2-02	Stop Key Function Selection	0	Coast To Stop	0
			1	Decel To Stop	
			2	Use B3-03 Method	
507h	O2-03	User Parameter Initialization Selection	0	No Change	0
			1	Set Defaults	
			2	Clear All	
508h	O2-04	KVA Selection	0 ~ FF		0
509h	O2-05	Operator M.O.P.	0	Disabled: Enter Key Required	0
			1	Enabled: Enter Key is not Required	
50Ah	O2-06	Digital Operator Detection	0	Disabled	1
			1	Enabled	
50Bh	O2-07	Elapsed Timer Setting	0 ~ 65535 Hour		0
50Ch	O2-08	Elapsed Timer Selection	0	Power On Time	1
			1	Running Time	
50Eh	O2-10	Fan Operating Time Setting	0 ~ 65535 Hour		0
515h	O3-01	Clear Fault history	0	Not Clear U2/U3	0
			1	Clear U2/U3	
516h	O3-02	Clear Count History	0	Not Clear	0
			1	Accumulated Operation Clear (U3-21 ~ 22)	
			2	Overload Load Check Clear (U3-23	
			3	Both 1 and 2 Cleared	

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
517h	O4-01	Copy Function Select	0	Copy Select	0
			1	Read: Inverter → Operator	
			2	Operator → Inverter	
			3	OP → Inverter Verify	
518h	O4-02	Read Selection	0	Disabled	1
			1	Enabled	
700h	T1-00	Motor Selection 1/2	0	1st Motor	0
			1	2nd Motor	
701h	T1-01	Tuning Mode Selection	0	Rotational Tune	0
			1	Stationary Auto Tune	
			2	Terminal Resistance	
			3	On-Dly Comp Tune	
702h	T1-02	Motor Output Power	0.4 ~ 650.0 HP		0.40
703h	T1-03	Motor Rated Voltage	0 ~ 255.5		230.0 (1)
704h	T1-04	Motor Rated Current	(2)		(3)
705h	T1-05	Base frequency	0 ~ 400.00Hz		60.00
706h	T1-06	Number of Motor Poles	2 ~ 48 Pole		4
707h	T1-07	Rated Motor Speed	0 ~ 24000 RPM		1750
708h	T1-08	PG Pulses/Rev	0 ~ 60000 RPM		1024

Notes (for this page only):

(1) For 400V class, the value is twice that for the 200V class

(2) Setting Range is 10 ~ 200% of inverter rated output current

(3) Initial value differs depending upon onverter capacity

Special Registers (Read / Write)

REGISTER (in hex)	FUNCTION	DATA SET	DESCRIPTION
FFDDh	ACCEPT	0	Activates newly written data
FFFDh	ENTER	0	Activates newly written data and saves to Non-Volatile memory

Chapter 6
Error Codes and Troubleshooting

- Communication Error (CE)
- Modbus Error Codes
- *Figure 6-1. Fault Response Message*
- IMPULSE Series 3 Drive Fault Codes

Communication Error

Once the data, sent from the master device, is received by the IMPULSE Series 3 drive, the received data is checked for CRC, parity, overrun, framing, and receiving buffer overflow. If all checked items pass, the data has been received normally. A communication error is declared if any of the checked data does not pass. A time-out detection can also cause a communication error. A time-out occurs if the drive does not receive a valid message addressed to itself within two seconds. A time-out will only cause a communication error if enabled by parameter H5-05 (as shown below).

H5-05 Setting	Description
0	Time-out detection disabled.
1	Time-out detection enabled.

The default setting of H5-05 is ‘1’.

The IMPULSE Series 3 drive will operate according to the setting of parameter H5-04 when a communication error (CE) occurs. The settings of H5-04 are as follows:

H5-04 Setting	Description
0	Deceleration to stop, and the Digital Operator flashes ‘CE’
1	Coast to stop, and the Digital Operator flashes ‘CE’
2	Deceleration to stop (C1-09), and the Digital Operator flashes ‘CE’
3	Operation continues, and the Digital Operator flashes ‘CE’

The default setting of H5-04 is ‘1’.

Modbus Error Codes

If there is an error in the command message, an error code will be returned in the response message. A fault response message is structured as follows:

SLAVE ADDRESS		xxh
80h + FUNC. CODE		xxh
ERROR CODE		03h
CRC-16	LOWER	xxh
	UPPER	xxh

Figure 6-1. Fault Response Message

The following table indicates the fault code for the specific type of fault that occurred.

Error Code	Name	Fault Content
01h	Function Error	Function Code other than 3, 8, 10 (hex)
02h	Register No. Error	Unregistered Register Number
03h	No. of Registers	Number of registers > 16
21h	Data Setting Error	Attempted to write beyond register's data limits
22h	Write-in Error	Write function is disabled for specified register
23h	Write during UV-Fault	Writing during drive main circuit under voltage condition
24h	Write during Processing	Attempting to write while processing parameters.

IMPULSE Series 3 Drive Fault Codes

The Impulse G+/VG+ Series 3 drive can have a fault, such as undervoltage, overload, external fault, etc. When a drive fault occurs, it can be classified as an alarm, a minor fault, or a major fault. The drive reacts differently with each type of fault. An alarm displays a warning indication, however operation continues. Minor faults allow continued operation, and a contact will close only if one of the multi-function outputs is set up as a minor fault contact. The major faults cause the motor to coast to stop, and the fault signal output is present at terminals MA, MB, and MC.

The IMPULSE Series 3 drive's parameters: U2-01 (Current Fault), U2-02 (Last Fault), and U3-01 through U3-04 (Last Fault; Fault Message 2, 3, & 4), each displays a fault code representing the type of drive fault. The following table indicates the abbreviation displayed on the digital operator and the hexadecimal code viewed in drive parameters U2-01, U2-02 and U3-01 when a specific drive fault occurs. The table also indicates whether the drive failure is an A – alarm, m – minor fault, or M – major fault.

IMPULSE Series 3 Drive Fault Codes – Continued

IMPULSE Series 3 Drive Fault	Digital Operator Display	Hexadecimal Code
DC Bus Fuse Open	PUF	1
DC Bus Undervoltage	UV1	2
CTL PS Undervoltage	UV2	3
MC Answerback	UV3	4
Short Circuit	SC	5
Ground Fault	GF	6
Overcurrent	OC	7
Overvoltage	OV	8
Heatsink Overtemperature	OH	9
Drive Overheat	OH1	A
Motor Overload	OL1	B
Drive Overload	OL2	C
Overtorque 1	OL3	D
Overtorque 2	OL4	E
Dynamic Braking Transistor	RR	F
Dynamic Braking Resistor	RH	10
External Fault 3	EF3	11
External Fault 4	EF4	12
External Fault 5	EF5	13
External Fault 6	EF6	14
External Fault 7	EF7	15
External Fault 8	EF8	16
Fan Fault	FAN	17
Overspeed	OS	18
Speed Deviation	DEV	19
PG Open	PGO	1A
Input Phase Loss	PF	1B
Output Phase Loss	LF	1C
DCCT Fault	CF	1D
Operator Disconnected	OPR	1E
EEPROM R/W Error	ERR	1F
Reserved		20
Modbus Com Error	CE	21
Communication Option Card	OPBUS	22
Serial Communication Error	E15	23
Option CPU Down	E10	24
Control Fault	CFxx	25
Zero Servo Fault	SVE	26
Noisy Encoder Fault	SVR	27
Snap Shaft	SS	28
Load Check Fault	LC1	29
Brake Answer-Back Fault	BE7	2A
PG Monitor Fault	PG02	2B
MFI Pulse Fault	PROX	2C
Out of Sync	SYNC	2D

IMPULSE Series 3 Drive Fault Codes – Continued

IMPULSE Series 3 Drive Fault	Digital Operator Display	Hexadecimal Code
Option External Fault	EF0	2E
Reserved		2F – 82
Base Block Circuit Fault	CPF02	83
EEPROM Fault	CPF03	84
Internal A/D Converter Fault	CPF04	85
External A/D Converter Fault	CPF05	86
Option Card Fault	CPF06	87
Reserved		88 – 90
Control Circuit Fault 20	CPF20	91
Control Circuit Fault 21	CPF21	92
Control Circuit Fault 22	CPF22	93
Control Circuit Fault 23	CPF23	94

Note: Further detail on drive faults can be found in Chapter 6 of the Impulse G+ and VG+ Series 3 drive instruction manual.

Appendix A
Run Operative Parameters

Register No.	Parameter	Parameter Description	Initial Value	Unit
100h	A1-00	Language Selection	0	-
101h	A1-01	Access Level	2	-
180h	B1-01	Frequency Ref. 1	15.00	Hz
181h	B1-02	Frequency Ref. 1	30.00	Hz
182h	B1-03	Frequency Ref. 1	60.00	Hz
183h	B1-04	Frequency Ref. 1	45.00	Hz
184h	B1-05	Frequency Ref. 1	60.00	Hz
185h	B1-06	Frequency Ref. 1	0.00	Hz
186h	B1-07	Frequency Ref. 1	0.00	Hz
187h	B1-08	Frequency Ref. 1	0.00	Hz
188h	B109	Frequency Ref. 1	0.00	Hz
189h	B1-10	Frequency Ref. 1	0.00	Hz
18Ah	B1-11	Frequency Ref. 1	0.00	Hz
18Bh	B1-12	Frequency Ref. 1	0.00	Hz
18Ch	B1-13	Frequency Ref. 1	0.00	Hz
18Dh	B1-14	Frequency Ref. 1	0.00	Hz
18Eh	B1-15	Frequency Ref. 1	0.00	Hz
18Fh	B1-16	Frequency Ref. 1	0.00	Hz
190h	B1-17	Jog Reference	6.00	Hz
194h	B2-03	Master Speed Ref Lower Limit	2	%
1A1h	B5-01	Acceleration Time 1	5.0	Sec.
1A2h	B5-02	Deceleration Time 1	3.0	Sec.
1A3h	B5-03	Acceleration Time 2	2.0	Sec.
1A4h	B5-04	Deceleration Time 2	2.0	Sec.
1ACh	B5-12	Acceleration Time 3	3.0	Sec.
1ADh	B5-13	Deceleration Time 3	3.0	Sec.
1AEh	B5-14	Acceleration Time 4	3.0	Sec.
1AFh	B5-15	Deceleration Time 4	3.0	Sec.
1C5h	C1-02	Quick Stop Time	1.0	Sec.
1C7h	C1-04	Plug Reverse Decel Time	2.0	Sec.
1C8h	C1-05	Plug Reverse Accel Time	2.0	Sec.
1CCh	C3-02	Upper Limit 1 Decel Time	1.0	Sec.
1CDh	C3-03	Upper Limit 2 Stop Time	0.5	Sec.
1CFh	C3-05	Lower Limit 1 Decel Time	1.0	Sec.
1D0h	C3-06	Lower Limit 2 Stop Time	1.0	Sec.
1D4h	C4-01	Load Float Time 2	10	Sec.
1D6h	C4-03	Load Float Count	10	-
1FCh	C8-10	Load Float Time	10	Sec.
1FEh	C8-12	BE6 Detect Timer	5.0	Sec.
201h	C8-15	Load Float Extention Timer	10	Sec.
207h	C8-21	Height Measure	250	Rev.

Appendix A
Run Operative Parameters - continued

Register No.	Parameter	Parameter Description	Initial Value	Unit
21Dh	C11-12	Gear Ratio Numerator	10000	-
21Eh	C11-13	Gear Ratio Denominator	10000	-
243h	D2-01	Slip Compensation Gain	0.0 / 1.0	-
249h	D3-01	Torque Compensation Gain	1.00	-
24Fh	D4-01	ASR Proportional Gain 1	1.00	-
250h	D4-02	ASR Integral Time 1	0.500 / .20	Sec.
251h	D4-03	ASR Proportional Gain 2	30.00	-
252h	D4-04	ASR Integral Time 2	0.100 / 0.050	Sec.
399h	F4-02	AO-08/AO-12 Channel 1 Gain	100.0	%
39Bh	F4-04	AO-08/AO-12 Channel 2 Gain	100.0	%
39Ch	F4-05	Channel 1 AO Bias	0.0	%
39Dh	F4-06	Channel 2 AO Bias	0.0	%
411h	H3-02	Terminal A1 Gain	100.0	%
412h	H3-03	Terminal A1 Signal Bias	0.0	%
415h	H3-06	Multi-function Analog Input Term. A3 Gain	100.0	%
417h	H3-07	Multi-function Analog Input Term. A3 Bias	0.0	%
419h	H3-10	Multi-function Analog Input Term. A2 Gain	100.0	%
41Ah	H3-11	Multi-function Analog Input Term. A2 Bias	0.0	%
41Eh	H4-02	Multi-function Analog Output 1 Gain	100.0	%
41Fh	H4-03	Multi-function Analog Output 1 Bias	0.0	%
421h	H4-05	Multi-function Analog Output 2 Gain	100.0	%
422h	H4-06	Multi-function Analog Output 2 Bias	0.0	%
42Dh	H6-02	Pulse Input Scaling	1440	Hz
42Eh	H6-03	Pulse Input Gain	100.0	%
42Fh	H6-04	Pulse Input Bias	0.0	%
430h	H6-05	Pulse Input Filter Time	0.1	Sec.
431h	H6-06	Pulse Output Selection	2	-
432h	H6-07	Pulse Output Scaling	1440	Hz
500h	O1-01	Monitor Selection	6	-
501h	O1-02	Monitor Selection after Power-up	1	-
504h	O1-05	LCD Brightness Adjust	3	-