

P7 Metasys® N2 Technical Manual

*This Manual
also available on
www.drives.com*



Models: CIMR-P7U*

Document Number: TM.P7.22



Warnings and Cautions

This Section provides warnings and cautions pertinent to this product that if not heeded, may result in personal injury, fatality or equipment damage. Yaskawa is not responsible for consequences of ignoring these instructions.

WARNING

YASKAWA manufactures component parts that can be used in a wide variety of industrial applications. The selection and application of YASKAWA products remain the responsibility of the equipment designer or end user. YASKAWA accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any YASKAWA product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and to fail safely under all circumstances. All products designed to incorporate a component part manufactured by YASKAWA must be supplied to the end user with appropriate warnings and instructions as to that part's safe use and operation. Any warnings provided by YASKAWA must be promptly provided to the end user. YASKAWA offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the YASKAWA manual. **NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED.** YASKAWA assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

WARNING

- Read and understand this manual before installing, operating, or servicing this drive. All warnings, cautions, and instructions must be followed. Qualified personnel must perform all activity. The drive must be installed according to this manual and local codes.
- Do not connect or disconnect wiring while the power is on. Do not remove covers or touch circuit boards while the power is on. Do not remove or insert the digital operator while power is on.
- Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. Status indicator LEDs and Digital Operator display will be extinguished when the DC bus voltage is below 50 VDC. To prevent electric shock, wait at least 5 minutes after all indicators are OFF and measure DC bus voltage and verify that it is at a safe level.
- Do not perform a withstand voltage test on any part of the unit. This equipment uses sensitive devices and may be damaged by high voltage.
- The drive is not suitable for circuits capable of delivering more than the specified RMS symmetrical amperes. Install adequate branch short circuit protection per applicable codes. Refer to the specification. Failure to do so may result in equipment damage and/or personal injury.
- Do not connect unapproved LC or RC interference suppression filters, capacitors, or over voltage protection devices to the output of the drive. Capacitors may generate peak currents that exceed drive specifications.
- To avoid unnecessary fault displays, caused by contactors or output switches placed between drive and motor, auxiliary contacts must be properly integrated into the control logic circuit.
- YASKAWA is not responsible for any modification of the product made by the user, doing so will void the warranty. This product must not be modified.
- Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.
- To meet CE directives, proper line filters and proper installation are required.
- Some drawings in this manual may be shown with protective covers or shields removed, to describe details. These must be replaced before operation.
- Observe Electrostatic Discharge Procedures when handling the drive and drive components to prevent ESD damage.
- The attached equipment may start unexpectedly upon application of power to the drive. Clear all personnel from the drive, motor and machine area prior to applying power. Secure covers, couplings, shaft keys, machine beds and all safety equipment before energizing the drive.

Introduction

The *Metasys N2* protocol is considered a CASE option for the P7U drive and is not included in the standard P7U drive. If the *Metasys N2* protocol is necessary, make sure that the correct drive has been ordered and received.

This manual explains the specifications and handling of the *Metasys N2* protocol for the Yaskawa model P7U drive. The P7U drive with the *Metasys N2* protocol selected, connects the P7U drive to a *Metasys N2* network and facilitates the exchange of data.

This document pertains to the Yaskawa P7U drive. Additionally, in this document, the word “inverter”, “ac drive” and “drive” may be used interchangeably.

To ensure proper operation of this product, read and understand this manual. For details on installation and operation of the P7U drive or details on specific P7U parameters, refer to the *P7U User Manual*, document reference **TM.P7.01**. For details on P7U MODBUS communications, refer to the *P7U MODBUS® Technical Manual*, document reference **TM.P7.11**. All technical manuals and support files are on the CD that was supplied with the drive and available for download at www.drives.com.

For more information on the *Metasys N2* protocol, please visit www.jci.com.

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MODBUS® is a registered trademark of Schneider Electric, Inc.

Metasys® N2 is a trademark of Johnson Controls, Inc.

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Chapter 1 Installation

This chapter covers the initial set-up procedure for the P7U drive on a Metasys N2 network.

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Installation Check Sheet

The following is a quick reference guide to the installation and configuration of the P7U drive with the *Metasys N2* protocol. Make a copy of this page and check-off each item as it is completed. For detailed information please refer to the detailed sections that follow.

- 1: Unpack the drive and verify that all components are present and undamaged.
- 2: Connect power to the drive and verify that the drive functions. This includes running the drive in local mode from the digital operator without the network selected or connected. Refer to the *P7U User Manual* for more information on connecting and operating the drive.
- 3: Remove power from the drive and wait for the charge lamp to be completely extinguished. Wait at least five additional minutes after all indicators are off. Measure the DC bus voltage and verify that it is at a safe level.
- 4: Connect the drive to the *Metasys N2* communication network. Refer to **Chapter 2 – Network Connection** for the *Metasys N2* connection procedure.
- 5: If this drive is either the first or the last device on the network, set the terminating resistor switch, S1-1, to ON. If this device is not the first or last device on the network, set the terminating resistor switch, S1-1, to OFF. Refer to **Chapter 2 – Network Connection** for details.
- 6: Configure the *Metasys N2* network for the drive as a VND device. Refer to the documentation included with the *Metasys N2* configuration software.
- 7: Set parameters b1-01, b1-02, H5-01, H5-02 and H5-08 to their appropriate values. Refer to **Table 1.1 - Drive Communication Parameter Settings** on page 1-5.

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Metasys N2 Set-Up

A Yaskawa Electric America, Inc. (YEA) representative is responsible for proper configuration of the drive for its primary application, while a Johnson Controls, Inc. representative is responsible for field panel programming to make use of the drive's functionality in the building automation system as a VND device. As such, there must be coordination between the Yaskawa Electric America and Johnson Controls representatives to ensure that the programming of the drive is consistent with the particular application requirements. After verifying that the drive installation and wiring are correct, apply power to the drive. Table 1.1 below lists the parameters and their values required for proper *Metasys N2* communication and control.

◆ P7U Drive Parameter Settings for *Metasys N2* Communications

Parameter Number	Digital Operator Display	Settings for <i>Metasys N2</i> Communication
b1-01	Reference Source	2: Serial Com
b1-02	Run Source	2: Serial Com
H5-01	Serial Comm Adr	Select the drive address (default = 1F hex (31 dec))
H5-02	Serial Baud Rate	3: 9600 Baud
H5-08	Protocol Select	1: N2 (<i>Metasys</i>)

CAUTION

A YEA representative should set the drive parameters to their appropriate values. Changes made to the parameters other than what is listed in the table above can result in damaging the drive or building equipment.

◆ Programming the P7U Drive for *Metasys N2*

The procedure for programming the P7U drive for communication on an *Metasys N2* network is shown in the table below: Refer to the *P7U User Manual, TM.P7.01*, for detailed information on using the P7U Operator.




Description	Key Operation	Digital Operator Display
Apply Power to the drive		-DRIVE- Rdy Frequency Ref U1-01 = 0.00Hz ----- U1-02 = 0.00Hz U1-03 = 0.00A
Select Programming Menu Press the MENU key until the display matches the display to the right.	 x3	-ADV- ** Main Menu ** ----- Programming
Enter Programming Menu Press the DATA ENTER key to select the Programming Menu (A1 blinking)		-ADV- Initialization ----- A1-00 = 0 Select Language
Select Sequence Parameters Press the UP ARROW key until <i>Reference Source</i> is displayed (b1 blinking). Note: The item selected will blink.	 x2	-ADV- Sequence ----- b1-01 = 2 Reference Source

Table 1.2 - Drive Programming Procedure for Metasys N2




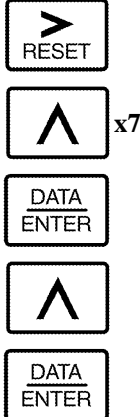
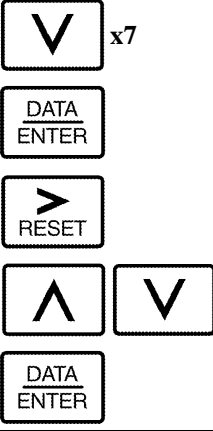



Description	Key Operation	Digital Operator Display
<p>Select Reference Command Source Press DATA ENTER key to edit b1-01 (value blinking). Press the UP ARROW key to change the parameter value until the display matches the display shown on the right. Press the DATA ENTER key to accept the entry. "Entry Accepted" will be displayed if successful.</p> <p>Note: Since communications has not been established, a "CALL" alarm may be generated. Press the STOP key to clear the alarm. If communications has not been established within the timeout interval, the alarm will reoccur. Press the STOP key to clear the "CALL" alarm whenever it occurs.</p>		<p>-ADV- Reference Source ----- b1-01 = 2 *2* Serial Com "1"</p>
<p>Select Run Command Source Press the UP ARROW key until <i>Run Source</i> is displayed (02 blinking). Press DATA ENTER key to edit b1-02 (value blinking). Press the UP ARROW key to change the parameter value until the display matches the display shown on the right. Press the DATA ENTER key to accept the entry. "Entry Accepted" will be displayed if successful. If 02 is blinking, press the RESET key to go back to the b1 menu (b1 blinking).</p>		<p>-ADV- Run Source ----- b1-02 = 2 *1* Serial Com "1"</p>
<p>Select Serial Communications Parameters Press the UP ARROW key until Serial Com Setup is displayed (H5 blinking).</p>		<p>-ADV- Serial Com Setup ----- H5-01 = 1F Serial Comm Adr</p>
<p>Select N2 (Metasys) Press the RESET key to select an H5 parameter (01 blinking). Press the UP ARROW key until H5-08 is displayed (08 blinking). Press the DATA ENTER key to edit the H5-08 parameter (value blinking). Press the UP ARROW key to change the parameter value until the display matches the display shown on the right. Press the DATA ENTER key to accept the entry. "Entry Accepted" will be displayed if successful.</p> <p>Note: N2 (Metasys) must be selected prior to setting the node address.</p>		<p>-ADV- Protocol Select ----- H5-08 = 1 *1* N2 (Metasys) "0"</p>

Table 1.2 - Drive Programming Procedure for Metasys N2

Description	Key Operation	Digital Operator Display
<p>Select Node Address Press the DOWN ARROW key until parameter H5-01 is displayed (01 blinking). Press the DATA ENTER key to edit parameter H5-01 (value blinking). Press the RESET or RIGHT ARROW key to select the digit to edit. The selected digit will blink. Press the UP ARROW or DOWN ARROW keys to change the value of the selected digit until the correct value is displayed. Press the DATA ENTER key to accept the entry. Edit all digits prior to pressing the DATA ENTER key. "Entry Accepted" will be displayed if successful.</p>		<p style="text-align: center;">-ADV- Serial Comm Adr</p> <hr style="border-top: 1px dashed black;"/> <p style="text-align: center;">H5-01 = 1F* (0~255) "1F"</p> <p style="font-size: small;">*This is always entered as a hexadecimal value. Refer to the conversion chart in Appendix B for information on converting decimal values to their hexadecimal equivalents</p>
<p>Select Baud Rate of 4800 Baud Press the UP ARROW key until parameter H5-02 is displayed (02 blinking). Press the DATA ENTER key to edit parameter H5-02 (value blinking). Press the UP ARROW key to change the parameter value until the display matches the display shown on the right. Press the DATA ENTER key to accept the entry. "Entry Accepted" will be displayed if successful.</p>		<p style="text-align: center;">-ADV- Serial Baud Rate</p> <hr style="border-top: 1px dashed black;"/> <p style="text-align: center;">H5-02 = 3 *3* 9600 Baud "3"</p>
<p>Select The Drive Mode</p>		<p style="text-align: center;">-DRIVE- ** Main Menu **</p> <hr style="border-top: 1px dashed black;"/> <p style="text-align: center;">Operation</p>
<p>Enter The Drive Mode</p>		<p style="text-align: center;">-DRIVE- Rdy Frequency Ref</p> <p style="text-align: center;">U1-01 = 0.00Hz</p> <hr style="border-top: 1px dashed black;"/> <p style="text-align: center;">U1-02 = 0.00Hz U1-03 = 0.00A</p>

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Chapter 2 Network Connection

This chapter discusses how to connect the P7U drive to a Metasys N2 network.

Physical Connection2 – 3

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Physical Connection

Communication on the network is half-duplex, two wire RS-485, with communication parameters fixed at 9600 baud, eight data bits, no parity and one stop bit. The network cable is a shielded two-conductor cable.

◆ Network Connection

- Connect a jumper between R+ and S+ and R- and S-.

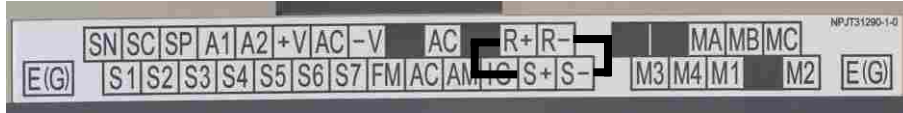


Figure 2.1 – P7U Terminal Block Jumper Connections

- Connect the positive (+) cable lead to S+. Connect the negative (-) cable lead to S-.

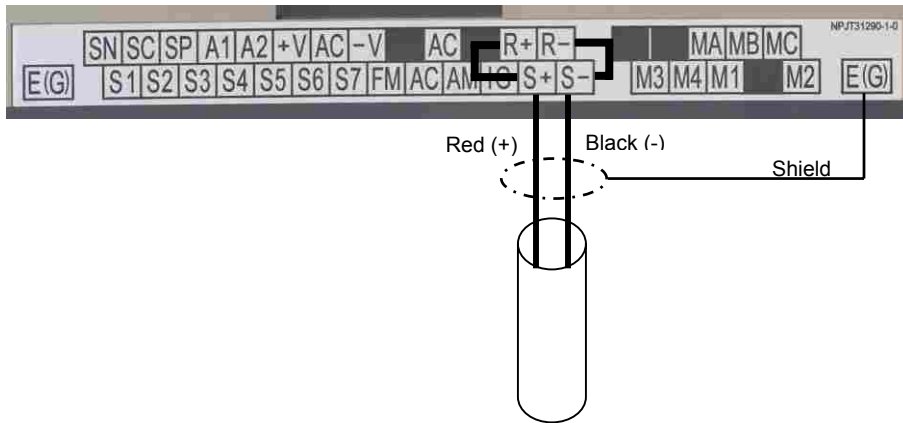


Figure 2.2 – Metasys N2 Network Cable Connections

◆ Network Termination

A bus-terminating resistor of 110Ω is available on each drive terminal board and can be applied to the *Metasys N2* communication bus by setting switch S1-1 to the ON position. In a multi-node system, only those nodes at the end of a bus segment should have terminating resistors. Before applying a terminating resistor as described above, care should be taken to understand the physical layout of the network and where other resistors might already be applied. An overloaded or improperly terminated bus may not function properly.

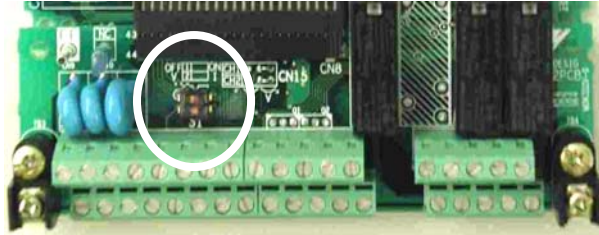


Figure 2.3 – Network Termination Resistor Setting

Table 2.1 - Terminating Resistor Switch Setting		
Switch Location	Function	Setting Choices
S1-1	RS-422 and RS-485 Terminating Resistance	OFF: No terminating resistance ON: Terminating resistance of 110Ω

Chapter 3 P7U Drive Functions

This chapter discusses the P7U drive functions and cable loss behavior.

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Cable Loss Behavior	3 – 4
P7U Drive Fault Numbers	3 – 6

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P7U Drive Functions

Each of the following functions must be enabled during start-up of the Drive:

- Start and stop the drive

Set the RUN FORWARD COMMAND (BO 1) to run the drive in the forward direction. Set the RUN REVERSE COMMAND (BO 2) to run the drive in the reverse direction. RUN/STOP MONITOR (BI 1) shows the current run status of the drive. FORWARD/REVERSE MONITOR (BI 2) shows the current direction.



Improper drive direction may damage HVAC equipment if parameter b1-04, Reverse Enable, is improperly set (b1-04 = 0).

- Lock the P7U panel

Locking the panel prevents the user from using the RUN and STOP keys locally at the drive panel. PANEL LOCK (BO 10) can be commanded to lock and unlock the panel.

- Digital Inputs

MULTI-FUNCTION INPUT 1 (BO 5) through MULTI-FUNCTION INPUT 5 (BO 9) are physical digital inputs on the drive. They can be set either by external devices, such as limit or pressure switches, or by the network. Their function depends on how the drive has been programmed. Refer to the *P7U User's Manual* section on Multi-Function Inputs (H1-01 through H1-05) for detailed information on the use and programming of the multi-function inputs. The multi-function input status can be monitored through MULTI-FUNCTION INPUT 1 MONITOR (BI 14) through MULTI-FUNCTION INPUT 5 MONITOR (BI 19). The MULTI-FUNCTION INPUT # MONITOR state is the logical OR of the serial command value (BO 5 through BO 9) and the state of the external connection.



Because the multi-function inputs can be set by both external devices or over the network, care must be taken when connecting the multi-function inputs to external devices to ensure correct system operation.

- Digital Outputs

MULTI-FUNCTION OUPUT 1 (BI 10) through MULTI-FUNCTION OUPUT 3 (BI 12) are physical digital outputs on the drive. Their function depends on how the drive has been programmed. Refer to the *P7U User's Manual* section on Multi-Function Outputs (H2-01 through H2-03) for detailed information on the use and programming of the multi-function outputs.

- Loop gain

PI PROPORTIONAL GAIN (AO 4) and PI INTEGRAL TIME (AO 5) are the gain and integral time parameters used by the P7U. The P7U PI loop is structured differently than the Metasys loop. Refer to the *P7U User's Manual* section on PID for information on how the P7U PI loop functions.

- Reading and resetting faults

FAULT MONITOR (BI 4) and DRIVE READY MONITOR (BI 3) show the current status of the drive. FAULT CODE (AI 10) contains the code for the most current fault. LST FLT CODE (AI 19) contains the code for the previous fault. See table below for descriptions of the fault codes. The drive fault can be reset through FAULT RESET COMMAND (BO 4). The FAULT RESET COMMAND is only available when the RUN FORWARD COMMAND and the RUN REVERSE COMMAND are both OFF.

Cable Loss Configuration and Behavior

This section describes the configurable cable loss feature of the drive. This feature offers a user maximum flexibility in determining the drive's response to a loss of communication.

◆ Drive Behavior At Loss of Communication

- After some interval without receipt of a message, the drive can be configured to respond in one of the following manners:
 - Continue at last speed
 - Continue at last speed with Alarm
 - Continue at preset speed
 - Ramp to Stop with EF0 fault
 - Coast to Stop with EF0 fault
 - Emergency Stop with EF0 fault

◆ Metasys N2 I/O

Three Metasys N2 outputs are used to select the desired behavior:

- **AO 21** – Cable Loss Timeout
- **AO 22** – Cable Loss Speed
- **BO 11** – Communication Fault Enable

Table 5.1 - Cable Loss Behavior Summary

Behavior	H5-04	Cable Loss Timeout (AO 121)	Cable Loss Speed (AO 22)	Communication Fault Enable (BO 11)
Decelerate to stop (stop time in C1-02) EF0 Fault	0	Timeout Interval	X	On
Coast to stop EF0 Fault	1	Timeout Interval	X	On
Emergency stop (stop time in C1-09) EF0 Fault	2	Timeout Interval	X	On
Continue at last speed	3	0	X	X
Continue at last speed with Alarm	3	Timeout Interval	X	On
Continue at preset speed with Alarm	4	Timeout Interval	Preset Speed	On

Notes:

1. Communication must first be established and then lost for these features to function as described. If a drive is powered-up without a cable connected or with the master controller offline, a communications timeout does not occur.
2. For modes which describe the drive running after a communications timeout, a run command must have been issued (BO 1 = 'On' or BO 2 = 'On') prior to loss of communications. For safety purposes, the drive will not automatically restart from a stopped condition. If a user requires the drive to restart automatically, additional external wiring is required to accomplish this (consult factory).

Upon expiration of the communications timeout interval, the FAULT LED lights and remains lit until communication is restored.

■ Continue at Last Speed

In this mode, Cable Loss Timeout (AO 21) is set to **0**, disabling the cable loss feature. The other two settings Cable Loss Speed (AO 22) and Communication Fault Enable (BO 11) are ignored. If communication is lost, the drive simply maintains its last commanded state. The drive will not display an alarm or fault to indicate it has lost communication. This behavior can also be achieved by setting parameter H5-04 to "3". The drive will display an alarm and continue running. For this specific condition, the Communication Fault Enable (BO 11) must be enabled and Cable Loss Timeout (AO 21) should be set to something other than 0.

■ Continue at Preset Speed

In this mode, Cable Loss Timeout (AO 21) is set to the desired interval, Cable Loss Speed (AO 22) is set to the desired preset speed and H5-04 is set to "4". If the time between messages exceeds the timeout interval, the drive's speed command (AO 1) is set to the Cable Loss Speed (AO 22) and the drive continues running at this new speed. Communication Fault Enable (BO 11) must be set to 'On'.

■ Stop

Communication Fault Enable (BO 11) must be set to 'On'. In this mode, Cable Loss Timeout (AO 21) is set to the desired interval and parameter H5-04 is set to a value of 0, 1 or 2. If the time between messages exceeds the timeout interval, the drive's speed command (AO 1) is set to 0. The stopping method is determined by the setting of H5-04. An **EF0** drive fault will be set.

- H5-04 = 0 selects Ramp to Stop. The deceleration time or the slope of the ramp is determined by the setting of drive parameter C1-02.
- H5-04 = 1 selects Coast to Stop. The drive does not attempt to control the rate of deceleration.
- H5-04 = 2 selects Emergency or Fast Stop. The deceleration time is determined by the setting of drive parameter C1-09.

 **CAUTION**

The behavior of the drive at cable loss is controlled by parameter H5-04. This drive parameter works with the points as described in the table above to determine how the drive will respond to a cable loss. If the cable loss fault is disabled, the drive will continue in its last state, if running the drive will continue to run at the last commanded frequency.

■ Fault (EF0)

In this mode, Cable Loss Timeout (AO 21) is set to the desired interval and Communication Fault Enable (BO 11) is set to '**On**'. If the time between messages exceeds the timeout interval, an '**EF0**' fault is declared and the drive stops. The stopping method is controlled by the setting of H5-04 and is described above. Cable Loss Speed (AO 22) is ignored.

P7U Drive Fault Numbers

Table 3.1 - Description of Fault Numbers	
Fault Number	Description
1	DC Bus Fuse Open (PUF)
2	DC Bus Under Voltage (UV1)
3	Control Power Supply Under Voltage (UV2)
4	MC Answerback (UV3)
5	Short Circuit Fault
6	Ground Fault (GF)
7	Over Current (OC)
8	DC Bus Over Voltage (OV)
9	Overheat Fault (OH)
10	Overheat 1 Fault (OH1)
11	Motor Overload (OL1)
12	Inverter Overload (OL2)
13	Over Torque Detection 1 (OL3)
14	Over Torque Detection 2 (OL4)
15	N/A
16	N/A
17	External Fault 3 (EF3)
18	External Fault 4 (EF4)
19	External Fault 5 (EF5)
20	External Fault 6 (EF6)
21	External Fault 7 (EF7)
22	External Fault 8 (EF8)
23	Drive Fan Fault
24	Over Speed Fault
25	N/A
26	N/A
27	N/A
28	Output Phase Loss (LF)
29	Overheat 3 (OH3)
30	Operator Connection Fault (OPR)
31	Err Fault
32	Overheat 4 Fault (OH4)
33	Memobus Com Error (CE)
34	N/A
35	N/A
36	N/A
37	N/A
38	N/A
39	External Fault 0 (EF0)
40	PID Feedback Loss
41	N/A
42	N/A
43	N/A

Chapter 4 Metasys N2 Point Database

This chapter shows the Metasys N2 point database. This database features 100 logical points: 38 Analog Inputs (AI), 32 Analog Outputs (AO), 19 Binary Inputs (BI) and 11 Binary Outputs (BO). These points configure, control or monitor the operation of the drive.

Metasys N2 Analog Input (AI) Summary	4 – 3
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Metasys N2 Binary Input (BI) Summary.....	4 – 5
Metasys N2 Binary Output (BO) Summary	4 – 5

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Metasys N2 Analog Input (AI) Summary

Table 4.1 – Metasys N2 Analog Input Summary (P7U to Metasys N2)			
Object ID	Object Name	Units	P7U Parameter
AI 1	SPEED REFERENCE	0.01 Hz	U1-01
AI 2	OUTPUT SPEED	0.01 Hz	U1-02
AI 3	OUTPUT CURRENT	0.1 A	U1-03
AI 4	kWATT HOUR METER	kWh	-
AI 5	OUTPUT POWER	0.1 kW	U1-08
AI 6	DRIVE TEMPERATURE	1°C	-
AI 7	PI FEEDBACK	0.01%	U1-24
AI 8	AC OUTPUT VOLTAGE	0.1Vac	U1-06
AI 9	DC BUS VOLTAGE	1Vdc	U1-07
AI 10	FAULT CODE	-	U2-01
AI 11	ELAPSED TIME - HOURS	1 HOUR	U1-13
AI 12	ELAPSED TIME – 10K HOURS	10K HOURS	U1-13
AI 13	MEGAWATT HOUR METER	MWh	U1-30
AI 14	DRIVE RATED CURRENT	A	n9-01
AI 15	COMMUNICATION ERROR CODE	-	U1-39
AI 16	PI DEVIATION	0.01%	U1-36
AI 17	PI OUTPUT CAPACITY	0.01%	U1-37
AI 18	PI REFERENCE	0.01%	U1-38
AI 19	LAST FAULT CODE	-	U2-02
AI 20	FREQ REF @ FAULT	0.01Hz	U2-03
AI 21	OUTPUT FREQ @ FAULT	0.01Hz	U2-04
AI 22	OUTPUT CURRENT @ FAULT	0.1A	U2-05
AI 23	OUT VOLT REF @ FAULT	0.1Vac	U2-07
AI 24	DC BUS VOLTS @ FAULT	1Vdc	U2-08
AI 25	OUTPUT POWER @ FAULT	0.1Kw	U2-09
AI 26	INPUT TERM STATUS @ FAULT	-	U2-11
AI 27	OUTPUT TERM STATUS @ FAULT	-	U2-12
AI 28	OPERATION STATUS @ FAULT	-	U2-13
AI 29	ELAPSED OPERATION TIME @ FAULT	1 HOUR	U2-14
AI 30	MOST RECENT FAULT	-	U3-01
AI 31	2 nd MOST RECENT FAULT	-	U3-02
AI 32	3 rd MOST RECENT FAULT	-	U3-03
AI 33	4 th MOST RECENT FAULT	-	U3-04
AI 34	ELAPSED TIME @ CURRENT FAULT	1 HOUR	U3-05
AI 35	ELAPSED TIME @ 2 nd FAULT	1 HOUR	U3-06
AI 36	ELAPSED TIME @ 3 rd FAULT	1 HOUR	U3-07
AI 37	ELAPSED TIME @ 4 th FAULT	1 HOUR	U3-08
AI 38	READ PARAMETER DATA	-	-

Metasys N2 Analog Output (AO) Summary

Table 4.2 – Metasys N2 Analog Output Summary (Metasys N2 to P7U)				
Object ID	Object Name	Units	Default Value	P7U Parameter
AO 1	SPEED COMMAND	0.01 Hz		-
AO 2	ACCELERATION TIME	SEC	30.0	C1-01
AO 3	DECELERATION TIME	SEC	30.0	C1-02
AO 4	PI PROPORTIONAL GAIN	-	2.00	b5-02
AO 5	PI INTEGRAL TIME	SEC	5.0	b5-03
AO 6	STALL PREVENTION LEVEL – RUN	%	120	L3-06
AO 7	STALL PREVENTION LEVEL – ACCEL	%	120	L3-02
AO 8	REFERENCE OPERATION MODE SELECT	-	1	b1-01
AO 9	RUN OPERATION MODE SELECT	-	1	b1-02
AO 10	PI MODE SELECT	-	0	b5-01
AO 11	FREQUENCY COMMAND UPPER LIMIT	% of MAX	100.0	d2-01
AO 12	FREQUENCY COMMAND LOWER LIMIT	% of MAX	0.0	d2-02
AO 13	MOTOR RATED CURRENT	A	Motor model dependent	E2-01
AO 14	JUMP FREQUENCY 1	0.1Hz	0.0	d3-01
AO 15	JUMP FREQUENCY 2	0.1Hz	0.0	d3-02
AO 16	JUMP FREQUENCY 3	0.1Hz	0.0	d3-03
AO 17	JUMP FREQUENCY BANDWIDTH	0.1Hz	1.0	d3-04
AO 18	NUMBER OF AUTO RESTARTS	-	0	L5-01
AO 19	OPERATOR DISPLAY MODE	-	0	o1-03
AO 20	POWER LOSS RIDE THROUGH	SEC	Drive model dependent	L2-02
AO 21	CABLE LOSS TIME-OUT	SEC	2.0	H5-09
AO 22	CABLE LOSS SPEED	0.01Hz	0.00	d1-04
AO 23	PI INTEGRAL LIMIT	0.1%	100.0	b5-04
AO 24	PI UPPER LIMIT VALUE	0.1	100.0	b5-06
AO 25	PI OFFSET ADJUSTMENT	0.1	0.0	b5-07
AO 26	PI PRIMARY DELAY TIME	0.01	0.00	b5-08
AO 27	PI FEEDBACK REFERENCE MISSING DETECTION SELECT	1	0	b5-12
AO 28	PI FEEDBACK REFERENCE MISSING DETECTION LEVEL	1%	0	b5-13
AO 29	PI FEEDBACK REFERENCE MISSING DETECTION TIME	0.1 SEC	1.0	b5-14
AO 30	READ PARAMETER NUMBER	-		-
AO 31	WRITE PARAMETER NUMBER	-		-
AO 32	WRITE PARAMETER DATA	-		-

Metasys N2 Binary Input (BI) Summary

Object ID	Object Name	Default	Off (0) State	On (1) State
BI 1	RUN / STOP MONITOR	0	STOPPED	RUNNING
BI 2	FORWARD / REVERSE MONITOR	0	FORWARD	REVERSE
BI 3	DRIVE READY MONITOR	0	NOT READY	READY
BI 4	FAULT MONITOR	0	NOT FAULTED	FAULTED
BI 5	ZERO SPEED	0	NOT ZERO SPEED	ZERO SPEED
BI 6	SPEED AGREE	0	NOT SPEED AGREE	SPEED AGREE
BI 7	MINOR FAULT	0	NO MINOR FAULT	MINOR FAULT
BI 8	MAJOR FAULT	0	NO MAJOR FAULT	MAJOR FAULT
BI 9	DRIVE COMMUNICATION ERROR MONITOR	0	NO ERROR	ERROR
BI 10	MULTI-FUNCTION OUTPUT 1 (H2-01)	0	-	-
BI 11	MULTI-FUNCTION OUTPUT 2 (H2-02)	0	-	-
BI 12	MULTI-FUNCTION OUTPUT 3 (H2-03)	0	-	-
BI 13	SAFETY INTERLOCK MONITOR	0	SAFETY CLEAR TERMINAL 3 CLOSED	SAFETY SET TERMINAL 3 OPEN
BI 14	HAND / AUTO REFERENCE MONITOR	0	REMOTE	LOCAL
BI 15	MULTI-FUNCTION INPUT 1 MONITOR	0	OFF	ON
BI 16	MULTI-FUNCTION INPUT 2 MONITOR	0	OFF	ON
BI 17	MULTI-FUNCTION INPUT 3 MONITOR	0	OFF	ON
BI 18	MULTI-FUNCTION INPUT 4 MONITOR	0	OFF	ON
BI 19	MULTI-FUNCTION INPUT 5 MONITOR	0	OFF	ON

Metasys N2 Binary Output (BO) Summary

Object ID	Object Name	Default	Off (0) State	On (1) State
BO 1	RUN FORWARD COMMAND	0	STOP	FORWARD
BO 2	RUN REVERSE COMMAND	0	STOP	REVERSE
BO 3	SERIAL FAULT (EF0) COMMAND	0	NO FAULT	FAULT
BO 4	FAULT RESET COMMAND	0	NO RESET	RESET
BO 5	MULTI-FUNCTION INPUT 1 (H1-01)	0	-	-
BO 6	MULTI-FUNCTION INPUT 2 (H1-02)	0	-	-
BO 7	MULTI-FUNCTION INPUT 3 (H1-03)	0	-	-
BO 8	MULTI-FUNCTION INPUT 4 (H1-04)	0	-	-
BO 9	MULTI-FUNCTION INPUT 5 (H1-05)	0	-	-
BO 10	PANEL LOCK	0	LOCAL/REMOTE AND STOP/RESET KEYS ENABLED	LOCAL/REMOTE AND STOP/RESET KEYS DISABLED
BO 11	COMMUNICATION FAULT ENABLE	0	EF0 NOT ACTIVATED IF CABLE LOSS OCCURS	EF0 ACTIVATED IF CABLE LOSS OCCURS

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Chapter 5 Mailbox Function

This chapter defines the Metasys N2 points that read and write P7U drive parameters.

Mailbox Function Points 5 – 3

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Mailbox Function Points

◆ Reading a Drive Parameter

Two points are defined for reading any drive parameter:

- AO 30 Specifies the parameter to be read from the P7U drive
- AI 38 Reports the value of the parameter specified in AO 30

When this point is read, it retrieves data from the parameter and sends it to the controller

- Example:

Writing a value of 387 (183 hex) to AO 30 specifies drive parameter b1-04. Reading AI 38 returns the current setting of parameter b1-04 to the controller

◆ Writing to a Drive Parameter

Two points are defined for writing to any drive parameter:

- AO 31 Specifies the parameter to be written to
- AO 32 Entry location of the value to be written to the parameter specified in AO 31. When this point is written to, it will write the value to the drive. An ENTER or ACCEPT command does not need to be sent for the data to be taken by the drive. The behavior of the write is the same as with the digital operator. If the drive is running, there are a limited number of drive parameters that can be written to.
- Example:

Writing a value of 387 (183 hex) to AO 31 specifies drive parameter b1-04. Writing a value of 1 to AO 32 enables the drive for reverse run.

Chapter 6 P7U Bypass Applications

This chapter lists the typical parameters for a bypass/engineered drive.

Bypass/Engineered Drive Parameter Settings..... 6 – 3

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Bypass/Engineered Drive Parameter Settings

For many applications, the drive is integrated into a *bypass* or *engineered* package. This type of package typically features an enclosure with contactors that allow the user to run the motor from line power (bypass mode) or from the drive (drive mode). This package also provides the flexibility for interfacing normally closed safety interlocks (fire status, freeze status, vibration sensors, etc.) which stop the drive if the contacts open.

◆ Typical Parameter Settings

A bypass/engineered drive is supplied with a list of parameters and their default values. Use the table below to record any parameter modifications for this particular application.

Table 7.1 - Typical Bypass/Engineered Drive Parameters

Parameter Number	Bypass Settings		Description
	Default	User	
E1-01			Input Voltage (VAC) – (default dependent on drive model)
E1-05			Maximum Output voltage (VAC) – (default dependent on drive mode)
E2-01			Motor Rated Current (FLA) (A) – (default dependent on drive model)
T1-02			Motor Rated Power (kW) – (default dependent on motor)
T1-04			Motor Rated Current (FLA) (A) – (default dependent on motor)
A1-01	2		Parameter Access Level (2 – Advanced)
b1-01			Frequency Reference Source (dependent on bypass options specified)
b1-02			Command Source (dependent on bypass options specified)
b1-03	0		Stopping Method (0 – Ramp to Stop) (ramp slope set by C1-02)
b1-04	1		Reverse Operation (1 – Disabled)
b1-07	1		Local/Remote RUN Selection (1 – Accept External RUN)
b1-08	1		RUN Command During Programming (1 – Enabled)
b1-12			HAND Mode Frequency Reference Selection (Operator Keypad)
b2-02	50%		DC Injection Braking Current (50%)
b2-03	5.0 sec		DC Injection Braking Current @ Start (5.0sec)
b2-09	0.0 A		Motor Preheat Current
b3-01	1		Speed Search Select (1 – Enabled (Speed Estimated))
b8-01	1		Energy Conservation Control Select (1 – Enabled)
C1-01	60.0 sec		Acceleration Time
C1-02	60.0 sec		Deceleration Time
d1-01	10.0 hz		Frequency Reference 1 (HAND Mode) (see H1-03)
d1-02	20.0 hz		Frequency Reference 2 (HAND Mode) (see H1-03)
E1-01			Input Voltage– (default dependent on drive model)
E1-03	7		V/F Pattern Select
E1-05			Output Voltage– Parameter defaults dependent on drive model
F6-01	3		Operation After Communication Loss (3 – Alarm Only)
H1-01	70 hex		Terminal S3 Function (Bypass Drv Enbl)
H1-02	6 hex		Terminal S4 Function (Local /Remote Select)
H1-03	6C hex		Terminal S5 Function (Frequency Reference 2 (N.O.))
H1-04	20 hex		Terminal S6 Function (External Fault (N.O.))

Table 7.1 - Typical Bypass/Engineered Drive Parameters

Parameter Number	Bypass Settings		Description
	Default	User	
H1-05	8 hex		Terminal S7 Function (External Base Block (N.O.))
H2-02	3B hex		Terminal M3-M4 (Command Source – Serial)
H3-08	2		Terminal A2 (0–10vdc)
H3-09	2		Terminal A2 (Auxiliary Frequency Reference)
H3-12	0.3 sec		Analog Input Filter Time
H3-13	0		Master Frequency Reference Terminal Select (0 – Terminal A1)
L2-01	2		Momentary Power Loss Detection Select (2 – CPU power active) (UV fault not detected)
L4-05	1		Frequency Reference Loss Detection Select (1 – RUN @ 80% of frequency prior to loss)
L5-01	10		Number of Re-Start Attempts
L5-03	600.0 sec		Maximum Restart Time After Fault
L6-01	6		Torque Detection Select (6 – No Load Detect and Alarm)
L6-02	15%		Torque Detection Level (% of drive rated current)
L6-03	10.0 sec		Torque Detection Time
L8-03	4		Overheat Pre-Alarm Operation Select (4 – Alarm and Reduce)
L8-11	300 sec		Heatsink cooling Fan Operation Delay Time
L8-19	20%		Overheat Frequency Reference Reduction Level
o2-01	0		Local/Remote Key Function (0 - Disabled)
o2-02	0		OFF Key Function (0 – Disabled)
o2-05	1		Frequency Reference Setting Method select (1 – Enabled) (Enter key Not Required from Keypad)
o2-08	1		Cumulative Operation Time Select (1 – Time @ RUN)
o3-02	1		Keypad COPY Function Select (1 – Enabled)

Appendix A Troubleshooting

This appendix describes the steps necessary to troubleshoot the P7U drive communicating on a Metasys N2 network.

Troubleshooting Check List	A - 3
Installing and Configuring Metasys N2.....	A - 5
Wiring And Cabling	A - 7
Drive Faults.....	A - 8

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Troubleshooting Check List

- 1: Connect power to the drive and verify that the drive operates correctly in local mode from the digital operator without being connected to the network. Record the drive model number and “spec” number at this time:

Model Number: CIMR-P7U ___ ___ ___ ___ (e.g. CIMR-P7U20P4)

”SPEC” Number: ___ ___ ___ ___ ___ ___ (e.g. 20P41A)

- 2: Record the control board part number:

ETC - ___ ___ ___ ___ ___ ___ - ___ ___ ___ ___ ___ ___ (e.g. ETC-618021-S2012)

- 3: All network devices have unique addresses and drives are addressed between 0-255 (0-FF hex).

Drive address: _____

- 4: The Run/Stop command source parameter, b1-02 is set correctly.

b1-02: _____

- 5: The Speed Command source parameter, b1-01, is set correctly.

b1-01: _____

- 6: The correct cable type is used: Mfg: _____ P/N: _____

- 7: All cable connections are correct per device schematic and are secure.

- 8: All cables have been checked for continuity. There are no breaks or shorts.

- 9: The network is correctly terminated.

- 10: The shield is continuous throughout the network and is properly grounded on each end.

- 11: The network cable is routed away from any high voltage cable(s) or source(s).

- 12: All network devices have been tested for conformance with the *Metasys N2* specification.

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Installing and Configuring Metasys N2

The following is a short guide to troubleshooting the *Metasys N2* installation and configuration. It highlights some of the most common issues faced when diagnosing and correcting issues associated with the startup and operation of an P7U drive with *Metasys N2* building automation network. While most of the information is centered on the application of the drive, the guidelines presented are applicable in most *Metasys N2* networks.

Diagnosis of network fault issues will typically fall into three categories: 1: Installation/set-up of *Metasys N2*, 2: wiring and cabling issues, and 3: network configuration/diagnostics. Each of these areas will be discussed after to help resolve common problems associated in *Metasys N2* network troubleshooting.

◆ Drive Operates Correctly Without Network Enabled

Before programming the drive for *Metasys N2* communication, **verify that the drive functions properly**. Refer to the *P7U User Manual* (TM.P7.01) for information on the drive’s installation and operation.

◆ Network Cable Is Connected Correctly And Securely

- Connect a jumper between R+ and S+ as well as R- and S-. Connect network cable to terminals S+ and S-.

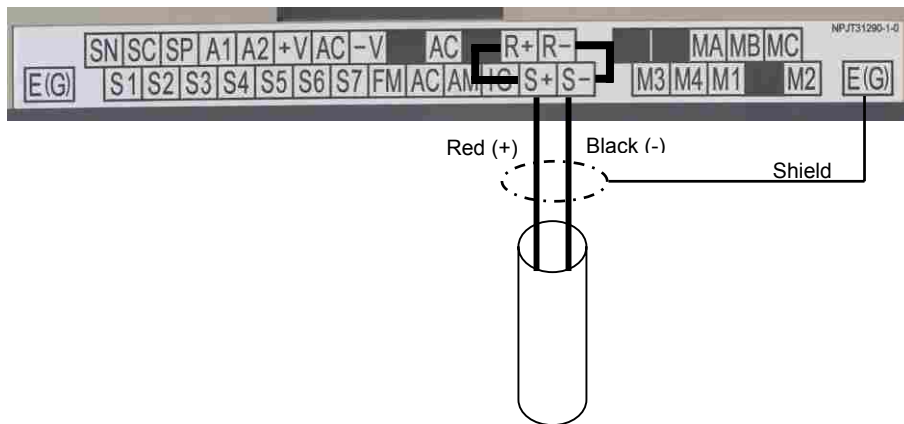


Figure A.1 – P7U Metasys N2 Network Connections

◆ Run/Stop Operation Parameter Is Set Correctly

The run/stop operation parameter needs to be set for “Serial Com”.

Parameter Number	Setting Choices	Setting Descriptions
b1-02	0	Operator
	1	Terminals
	2	Serial Com (Metasys N2)
	3	Option PCB

◆ Speed Command Operation Parameter Is Set Correctly

The speed command operation parameter needs to be set for “Serial Com”.

Table A.2 - Speed Command Operation Parameter		
Parameter Number	Setting Choices	Setting Descriptions
b1-01	0	Operator
	1	Terminals
	2	Serial Com (Metasys N2)
	3	Option PCB

◆ Correct and Unique Network Address

Each device on a *Metasys N2* network requires its own unique address. The drive also needs to be programmed to accept the *Metasys N2* protocol.

Table A.3 - Serial Communication Device Address Parameter		
Parameter Number	Setting Range	Setting Description
H5-01	0 to FFh (0 to 255 dec)x	Serial communication device address
H5-08	0 to 2	1: N2 (Metasys)

Wiring And Cabling

◆ The network cable is the correct type

Table A.4 - Metasys N2 Cable Specifications	
Specification	Description
Cable Configuration	Twisted Shielded Pair
Gauge	18-20 AWG (Solid or Stranded)
Wire Lay	Minimum 6 twists per foot
Shields	100% foil with drain wire
NEC Type	UL Type CMP
Temperature	60°C or higher

◆ Cable Lengths Are Within Specified Limits

Cable lengths cannot exceed 500 feet at 9600 baud.

◆ The Network is Terminated Correctly

A bus terminating resistor of 110Ω is available on each drive terminal board and can be applied to the *Metasys N2* communication bus by setting switch S1-1 to the ON position.

In a multi-node system, only those nodes at the end of a bus segment should have terminating resistors. Before applying a terminating resistor as described above, care should be taken to understand the physical layout of the network and where other resistors might already be applied. An overloaded or improperly terminated bus may not function properly.

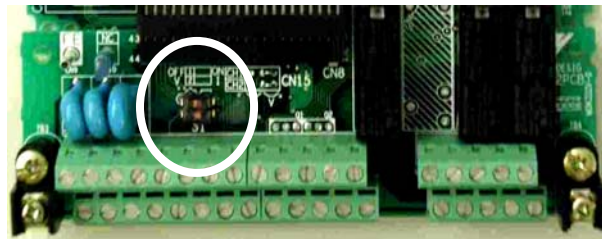


Figure A.2 – Termination Resistor Setting

Table A.5 - Terminating Resistor Switch Setting		
Switch Location	Function	Setting Choices
S1-1	RS-422 and RS-485 Terminating Resistance	OFF: No terminating resistance ON: Terminating resistance of 110Ω

◆ Shield Is Continuous And Both Ends Of The Shield Are Grounded

As each drive is daisy-chained to the next, twist together the shields of the adjoining cables. Do not connect the shield at each drive. The continuous shield should then be single-point grounded at the field panel.

◆ Cable Is Routed Correctly

Route the cable away from all power and high frequency lines. Routing within a separate conduit is preferred.

Drive Faults

◆ Communications Fault

Table A.6 - Drive Faults			
Fault	Description	Cause	Corrective Action
CE	Memobus Communication Error	Connection is broken or master has stopped communicating	Check all connections Verify all Metasys N2 software configurations

◆ P7U Drive Faults

Table A.7 - Description of Fault Numbers	
Fault Number	Description
1	DC Bus Fuse Open (PUF)
2	DC Bus Under Voltage (UV1)
3	Control Power Supply Under Voltage (UV2)
4	MC Answerback (UV3)
5	Short Circuit Fault
6	Ground Fault (GF)
7	Over Current (OC)
8	DC Bus Over Voltage (OV)
9	Overheat Fault (OH)
10	Overheat 1 Fault (OH1)
11	Motor Overload (OL1)
12	Inverter Overload (OL2)
13	Over Torque Detection 1 (OL3)
14	Over Torque Detection 2 (OL4)
15	N/A
16	N/A
17	External Fault 3 (EF3)
18	External Fault 4 (EF4)
19	External Fault 5 (EF5)
20	External Fault 6 (EF6)
21	External Fault 7 (EF7)
22	External Fault 8 (EF8)
23	Drive Fan Fault
24	Over Speed Fault
25	N/A
26	N/A
27	N/A
28	Output Phase Loss (LF)
29	Overheat 3 (OH3)
30	Operator Connection Fault (OPR)
31	Err Fault
32	Overheat 4 Fault (OH4)
33	Memobus Com Error (CE)
34	N/A
35	N/A
36	N/A
37	N/A
38	N/A
39	External Fault 0 (EF0)
40	PID Feedback Loss
41	N/A
42	N/A
43	N/A

Appendix B Hex/Dec Conversion

This appendix describes the decimal to hexadecimal conversion.

Hex/Dec Conversion Table B - 3

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Hex/Dec Conversion Table

Table B.1 – Hex/Dec Conversions

Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec
0	0	34	52	68	104	9C	156	D0	208		
1	1	35	53	69	105	9D	157	D1	209		
2	2	36	54	6A	106	9E	158	D2	210		
3	3	37	55	6B	107	9F	159	D3	211		
4	4	38	56	6C	108	A0	160	D4	212		
5	5	39	57	6D	109	A1	161	D5	213		
6	6	3A	58	6E	110	A2	162	D6	214		
7	7	3B	59	6F	111	A3	163	D7	215		
8	8	3C	60	70	112	A4	164	D8	216		
9	9	3D	61	71	113	A5	165	D9	217		
A	10	3E	62	72	114	A6	166	DA	218		
B	11	3F	63	73	115	A7	167	DB	219		
C	12	40	64	74	116	A8	168	DC	220		
D	13	41	65	75	117	A9	169	DD	221		
E	14	42	66	76	118	AA	170	DE	222		
F	15	43	67	77	119	AB	171	DF	223		
10	16	44	68	78	120	AC	172	E0	224		
11	17	45	69	79	121	AD	173	E1	225		
12	18	46	70	7A	122	AE	174	E2	226		
13	19	47	71	7B	123	AF	175	E3	227		
14	20	48	72	7C	124	B0	176	E4	228		
15	21	49	73	7D	125	B1	177	E5	229		
16	22	4A	74	7E	126	B2	178	E6	230		
17	23	4B	75	7F	127	B3	179	P7U	231		
18	24	4C	76	80	128	B4	180	E8	232		
19	25	4D	77	81	129	B5	181	E9	233		
1A	26	4E	78	82	130	B6	182	EA	234		
1B	27	4F	79	83	131	B7	183	EB	235		
1C	28	50	80	84	132	B8	184	EC	236		
1D	29	51	81	85	133	B9	185	ED	237		
1E	30	52	82	86	134	BA	186	EE	238		
1F	31	53	83	87	135	BB	187	EF	239		
20	32	54	84	88	136	BC	188	F0	240		
21	33	55	85	89	137	BD	189	F1	241		
22	34	56	86	8A	138	BE	190	F2	242		
23	35	57	87	8B	139	BF	191	F3	243		
24	36	58	88	8C	140	C0	192	F4	244		
25	37	59	89	8D	141	C1	193	F5	245		
26	38	5A	90	8E	142	C2	194	F6	246		
27	39	5B	91	8F	143	C3	195	F7	247		
28	40	5C	92	90	144	C4	196	F8	248		
29	41	5D	93	91	145	C5	197	F9	249		
2A	42	5E	94	92	146	C6	198	FA	250		
2B	43	5F	95	93	147	C7	199	FB	251		
2C	44	60	96	94	148	C8	200	FC	252		
2D	45	61	97	95	149	C9	201	FD	253		
2E	46	62	98	96	150	CA	202	FE	254		
2F	47	63	99	97	151	CB	203	FF	255		
30	48	64	100	98	152	CC	204	100	256		
31	49	65	101	99	153	CD	205				
32	50	66	102	9A	154	CE	206				
33	51	67	103	9B	155	CF	207				

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