Lenze
AC Tech

MCH Series Drives

Metasys N2 Communications Guide

About These Instructions

This documentation applies to the use of an MCH Series Variable Frequency Drive with Metasys N2 protocol and should be used in conjunction with the MCH Series Installation and Operation Manual (Document MH01) that shipped with the drive. These documents should be read in their entirety as they contain important technical data and describe the installation and operation of the drive.

Metasys® is a registered trademark of Johnson Controls, Inc., http://www.johnsoncontrols.com

Contents

1 Safety Information

1.1 Warnings, Cautions and Notes

1.1.1 General

Some parts of Lenze controllers (frequency inverters, servo inverters, DC controllers) can be live, moving and rotating. Some surfaces can be hot.

Non-authorized removal of the required cover, inappropriate use, and incorrect installation or operation creates the risk of severe injury to personnel or damage to equipment.

All operations concerning transport, installation, and commissioning as well as maintenance must be carried out by qualified, skilled personnel (IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC report 664 or DIN VDE0110 and national regulations for the prevention of accidents must be observed).

According to this basic safety information, qualified skilled personnel are persons who are familiar with the installation, assembly, commissioning, and operation of the product and who have the qualifications necessary for their occupation.

1.1.2 Application

Drive controllers are components designed for installation in electrical systems or machinery. They are not to be used as appliances. They are intended exclusively for professional and commercial purposes according to EN 61000-3-2. The documentation includes information on compliance with EN 61000-3-2.

When installing the drive controllers in machines, commissioning (i.e. the starting of operation as directed) is prohibited until it is proven that the machine complies with the regulations of the EC Directive 98/37/EC (Machinery Directive); EN 60204 must be observed.

Commissioning (i.e. starting drive as directed) is only allowed when there is compliance to the EMC Directive (2004/108/EC).

The drive controllers meet the requirements of the Low Voltage Directive 2006/95/EC. The harmonised standards of the series EN 50178/DIN VDE 0160 apply to the controllers.

The availability of controllers is restricted according to EN 61800-3. These products can cause radio interference in residential areas. In the case of radio interference, special measures may be necessary for drive controllers.

1.1.3 Installation

Ensure proper handling and avoid excessive mechanical stress. Do not bend any components and do not change any insulation distances during transport or handling. Do not touch any electronic components and contacts. Controllers contain electrostatically sensitive components, which can easily be damaged by inappropriate handling. Do not damage or destroy any electrical components since this might endanger your health! When installing the drive ensure optimal airflow by observing all clearance distances in the drive's user manual. Do not expose the drive to excessive: vibration, temperature, humidity, sunlight, dust, pollutants, corrosive chemicals or other hazardous environments.

1.1.4 Electrical Connection

When working on live drive controllers, applicable national regulations for the prevention of accidents (e.g. VBG 4) must be observed.

The electrical installation must be carried out in accordance with the appropriate regulations (e.g. cable cross-sections, fuses, PE connection). Additional information can be obtained from the regulatory documentation.

The regulatory documentation contains information about installation in compliance with EMC (shielding, grounding, filters and cables). These notes must also be observed for CE-marked controllers.

The manufacturer of the system or machine is responsible for compliance with the required limit values demanded by EMC legislation.

1.1.5 Operation

Systems including controllers must be equipped with additional monitoring and protection devices according to the corresponding standards (e.g. technical equipment, regulations for prevention of accidents, etc.). You are allowed to adapt the controller to your application as described in the documentation.

DANGER!
- After the controller has been disconnected from the supply voltage, do not touch the live components and power connection until the capacitors have discharged. Please observe the corresponding notes on the controller.
- Do not continuously cycle input power to the controller more than once every three minutes.
- Close all protective covers and doors during operation.

WARNING!
Network control permits automatic starting and stopping of the inverter drive. The system design must incorporate adequate protection to prevent personnel from accessing moving equipment while power is applied to the drive system.

Table 1: Pictographs used in these instructions

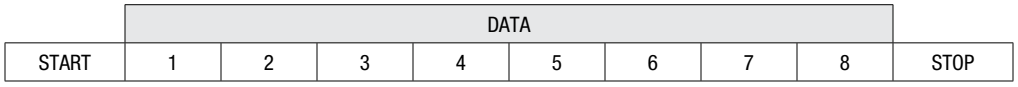
Pictograph	Signal word	Meaning	Consequences if ignored
	**DANGER!**	Warning of Hazardous Electrical Voltage.	Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
	**WARNING!**	Impending or possible danger for persons	Death or injury
	**STOP!**	Possible damage to equipment	Damage to drive system or its surroundings
	**NOTE**	Useful tip: If observed, it will make using the drive easier	

2 Introduction

This document will explain how to operate a Lenze-AC Tech MCH Variable Frequency Drive using Metasys N2 protocol. It is intended as a serial communications supplement only and will not discuss normal drive operations. For more information regarding normal drive setup and functionality, refer to the MCH Installation and Operation Manual (MH01).

2.1 Metasys N2 Communications

MCH drives running N2 protocol act as N2 devices on a Metasys® Network and function as slaves only. Thus the device communicating with an MCH drive must be an N2 master. The communication rate is 9600 bps with 8 data bits, no parity, 1 start bit and 1 stop bit. The bit sequence is as follows:



2.2 Serial Communications Wiring

Figure 1 illustrates the MCH Series Terminal Strip and connections for the N2 Metasys network.

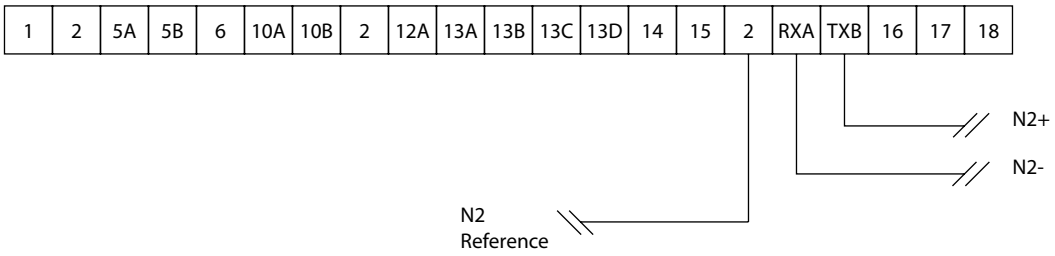


Figure 1: MCH Terminal Strip

The **N2+** terminal is connected to MCH drive terminal RXA

The **N2-** terminal is connected to MCH drive terminal TXB

The **N2** Reference is connected to MCH drive terminal 2.

3 Drive Setup and Programming

Most drive parameters (including those required for serial communications) are not accessible through the N2 Network. They can only be accessed by entering the Programming Mode of the drive itself. Refer to the MCH Installation and Operation Manual (MH01) for more information.

When in Programming Mode, the drive will not accept any write, memorize or characterize commands from the N2 Network. This is necessary to prevent conflicts between the two modes of parameter modification.

3.1 Serial Communication Setup

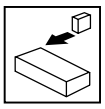
The factory default values for all drive parameters are setup to allow immediate serial communications (without serial start and serial speed/setpoint commands). For serial speed/setpoint and/or serial start control, modify the setting of Drive Parameter #30 (Control). The drive parameters that are required for serial communications, including Drive Parameter #30, are described below.

30 CONTROL — This parameter should be set to accommodate the specific application intent:

- NORMAL — Serial start and serial speed/setpoint commands are invalid. Therefore Points 3-03, 3-04 and 3-05 are forced to act as monitor points only and Point 4-01 can only be commanded to 0 (STOP).
- NORM NO HAND — Same as NORMAL except the HAND/OFF/AUTO, herein referred to as H/O/A, is limited to settings of OFF and AUTO.
- SERIAL SPEED — Serial start commands are invalid. Point 4-01 can only be commanded to 0 (STOP). Points 3-03, 3-04 and 3-05, the serial speed/setpoint commands, are valid in AUTO H/O/A only.
- S SPD/NO HAND — Same as SERIAL SPEED except H/O/A is limited to settings of OFF and AUTO.
- SERIAL AUTO — This setting forces the drive to be started over the N2 Network when in AUTO H/O/A. Serial start and serial speed/setpoint commands are all valid in AUTO H/O/A.
- S AUTO/NO HND — Same as SERIAL AUTO except H/O/A is limited to settings of OFF and AUTO. Serial STOP commands are accepted from the N2 Network regardless of this parameter setting.

57 SERIAL — This parameter must be set to either WITH TIMER (default) or W/O TIMER for the drive to communicate with the N2 Network. Serial communications will not work if this parameter is set to DISABLED.

58 SERIAL ADDRESS — This parameter contains the address of the N2 Network device. It is adjustable from 1–255.



60 SERIAL TIMEOUT — This parameter makes the serial watchdog timeout period selectable. It has a minimum value of 10 seconds and maximum value of 1800 seconds. The default value is 120 seconds. If no action is to be taken when a serial watchdog timeout occurs, Drive Parameter #57 (Serial) should be set to W/O TIMER. This will disable the watchdog timer. Otherwise Drive Parameter #57 (Serial) should be set to WITH TIMER and if the drive is running in AUTO HOA, it will trip into a SERIAL FAULT when the watchdog timeout occurs, stopping the drive.

When a watchdog timeout occurs in AUTO HOA, the drive is taken out of serial control and any overrides that were in effect are released.

3.2 Communication Overrides

Overrides are also released under the following circumstances:

- Drive Parameter #57 (Serial) is set to DISABLED.
- Drive Parameter #58 (Serial Address) is changed.
- Drive Parameter #30 (Control) is changed.
- Drive Parameter #65 (Program) is changed to RESET 60 or REST 50 (i.e., a factory reset is performed) and Drive Parameter #58 (Serial Address) was not previously set to 30. In this case, serial communications will be terminated immediately.
- Drive Parameter #65 (Program) is changed to RESET 60 or REST 50 (i.e., a factory reset is performed) and Drive Parameter #30 (Control) was not previously set to NORMAL.
- The drive HOA is changed from AUTO to either HAND or OFF.

In the above circumstances, if the drive is running in AUTO HOA and control parameters are unlocked, then the drive will be brought to a STOP. The resulting stop condition will depend on the setting Drive Parameter #30 (Control):

- KSTOP for settings of NORMAL, NORM NO HAND, SERIAL SPEED, and S SPD/NO HAND. A keypad AUTO or HAND START are required to restart the drive.
- SSTOP for settings of SERIAL AUTO and S AUTO/NO HND. A serial start command is required to restart the drive.

NOTE - Drive Stop unrelated to Serial Communication

The drive will also be brought to a stop if Drive Parameter #49 (TB13C Input) is changed to or from HAND (i.e., the HOA is changed from LOCAL to REMOTE or from REMOTE to LOCAL). The specific stop condition will be dictated by the setting of Drive Parameter #30 (Control).

4 MCH N2 Points

The MCH N2 Points are divided into four types: analog input, binary input, analog output and binary output. Sections 4.2 through 4.5 describe each of these point types and the individual point numbers within each.

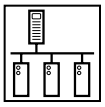
4.1 Metasys N2 Point Map

Table 2: Metasys N2 Point Map for MCH Series Drives

Point Type [1]	Point #	COS [2]	Status Point [3]	Description (Point Name)	Point Units	Decimal Places	MIN Value	MAX Value	Default Value
1	01	Yes	Yes	Actual Frequency (OUTPUT FREQ)	HZ	2	0	12000	0
1	02	Yes	Yes	Command Frequency (COMMAND FREQ)	HZ	2	0	12000	2000
1	03	Yes	Yes	Load Percent (LOAD PERCENT)	PCT	0	0	255	0
1	04	Yes	Yes	Total Runtime (RUNTIME HRS)	HRS	0	0	65535	0
1	05	Yes	Yes	DC Bus Voltage (DC BUS VOLTS)	PCT	0	0	255	0
1	06	Yes	Yes	Operational Status (RUN STATUS)	--	0	0	10	3
1	07	Yes	Yes	H/O/A Mode (HOA MODE)	--	0	0	2	0
1	08	Yes	Yes	PID Setpoint Command (PID SETPOINT)	Note 4	0	Note 4	Note 4	50
1	09	Yes	Yes	PID Feedback (PID FEEDBACK)	Note 4	0	Note 4	Note 4	0
1	10	Yes	Yes	Present Fault (FAULT)	--	0	0	24	0
2	01	Yes	Yes	PID Mode (PID MODE)	--	--	DIS	ENA	DIS
2	02	Yes	Yes	Current Direction (FWD.REV)	--	--	FWD	REV	FWD
2	03	Yes	Yes	Run/Stop Status (RUN.STOP)	--	--	STP	RUN	STP
2	04	Yes	Yes	TB-14 / Relay #2 (TB14.RELAY2)	--	--	OFF	ON	OFF
2	05	Yes	Yes	TB-15 / Relay #3 (TB15.RELAY3)	--	--	OFF	ON	OFF
2	06	Yes	Yes	Relay #1 (RELAY1)	--	--	OFF	ON	OFF
2	07	Yes	Yes	Fault Condition (OK.FAULT)	--	--	OK	FLT	OK
2	08	Yes	Yes	Serial Watchdog (SERIAL WATCHDOG)	--	--	ENA	DIS	ENA
3	01	Yes	No	Acceleration Rate (ACCEL RATE)	SEC	1	0	36000	300
3	02	Yes	No	Deceleration Rate (DECEL RATE)	SEC	1	0	36000	300
3	03	Yes	No	Speed Source Selection (SOURCE SEL)	--	0	0	2	0
3	04	Yes	No	Keypad Speed Command (KEY SPD CMD)	HZ	2	0	12000	2000
3	05	Yes	No	Keypad Setpoint Command (KEY STPT CMD)	Note 4	0	Note 4	Note 4	50
4	01	Yes	No	Start/Stop Drive (CMD RUN.STOP)	--	--	STP	RUN	STP
4	02	Yes	No	Disable Serial Watchdog (DIS SER WATCHDOG)	--	--	NRM	DIS	NRM
4	03	Yes	No	Clear Present Fault (CLEAR FAULT)	--	--	NRM	RST	NRM

NOTES:

1. Point Types: 1= AI (Analog Input); 2 = BI (Binary Input); 3 = AO (Analog Output); 4 = BO (Binary Output)
2. COS: Change of State
3. Status Points: for monitoring purposes only and cannot be overridden; Yes = Point can be used as a status point; No = Point cannot be used as a status point.
4. Units, MIN/MAX Values: for this point are defined via Drive Parameters #31, 75 and 76 respectively. Refer to notes in sections 4.2 and 4.4.



4.2 Analog Input (AI) Point Descriptions

Point **Description**

1-01: Actual Frequency
This point represents the actual speed of the drive in Hz.

1-02: Command Frequency
This point represents the commanded drive speed in Hz.

1-03: Load Percent
This point represents the drive's load current as a % of rated current. This value can also be seen on the local display.

1-04: Total Runtime
This point represents the number of hours that the drive has been running since its first power-up.

1-05: DC Bus Voltage
This point represents the drive's DC Bus Voltage as a percentage of the nominal DC bus voltage.

1-06: Operational Status
This point is for monitoring the actual operating condition of the drive. The value returned is a number between 0 and 10 which corresponds to one of the following operating states:

Value	Operational State
0	FAULT LOCKOUT
1	FAULT
2	START PENDING
3	STOP
4	DC BRAKE
5	RUN AT 0Hz
6	RUN
7	ACCEL
8	DECEL
9	CURRENT LIMIT
10	DECEL OVERRIDE

1-07: H/O/A Mode
This point is for monitoring the drive H/O/A status. If the drive H/O/A is OFF, this point will return 0 and serial speed/setpoint and serial start commands will not be accepted. If the drive H/O/A is HAND, this point will return 1 and serial speed/setpoint and serial start commands will not be accepted. If the drive H/O/A is AUTO, this point will return 2 and, depending on the setting of Drive Parameter #30 (Control), serial speed/setpoint and serial start commands will be accepted. For more information, refer to Section 3.1 Serial Communication Setup.

Point **Description**

1-08: PID Setpoint Command

This point is for monitoring the commanded PID Setpoint and is displayed in the drive's internal PID units with a range of 0-32736. A value of 0 represents the lower of Drive Parameter #75 (Feedback @ Min) and Drive Parameter #76 (Feedback @ Max). A value of 32736 represents the higher of Drive Parameter #75 (Feedback @ Min) and Drive Parameter #76 (Feedback @ Max).

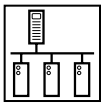
1-09: PID Feedback

This point is for monitoring the current PID Feedback value at the input specified by Drive Parameter #74 (PID Feedback). It is displayed in the drive's internal PID units with a range of 0-32736. A value of 0 represents the lower of Drive Parameter #75 (Feedback @ Min) and Drive Parameter #76 (Feedback @ Max). A value of 32736 represents the higher of Drive Parameter #75 (Feedback @ Min) and Drive Parameter #76 (Feedback @ Max).

1-10: Present Fault

This point indicates the type of fault on which the drive is currently tripped. This point returns a value between 0 and 24 which corresponds to one of the following fault conditions:

Value	Fault
0	NO FAULT
1	OUTPUT FAULT
2	E-STOP
3	HIGH DC BUS VOLTS
4	HIGH DRIVE TEMPERATURE
5	THERMAL OVERLOAD
6	OUTPUT FAULT
7	LOW DC BUS VOLTS
8	START ERROR
9	DC BRAKE ERROR
10	FOLLOWER LOSS
11	DB ERROR
12	POWER SAG
13	CONTROL FAULT
14	LANGUAGE
15	EXTERNAL FAULT
16	INTERNAL16
17	POWER TRANSIENT
18	S/W ERROR #1
19	S/W ERROR #2
20	S/W ERROR #3
21	S/W ERROR #4
22	S/W ERROR #5
23	GENERAL S/W ERROR
24	SERIAL COMMUNICATION LOSS



4.3 Binary Input (BI) Point Descriptions

Point	Description
2-01:	PID Mode This point is for monitoring the general state of the drive's PID mode. If Drive Parameter #70 (PID Mode) is set to OFF this point returns 0 (DISABLED). If Drive Parameter #70 is set to either NORMAL or REVERSE, then this point returns 1 (ENABLED).
2-02:	Current Direction This point indicates the direction in which the drive is currently running.

Point	Description
2-03:	Run / Stop Status This point indicates whether or not the drive is currently running.
2-04:	TB-14 / Relay #2 This point monitors the state of the drive's TB-14 or Relay #2 output. This point can be used to indicate various drive conditions as specified by Drive Parameter #52 (TB14/Relay #2). Refer to the MCH Installation and Operation Manual (MH01) for more information.
2-05:	TB-15 / Relay #3 This point monitors the state of the drive's TB-15 or Relay #3 output. This point can be used to indicate various drive conditions as specified by Drive Parameter #53 (TB15/Relay #3). Refer to the MCH Installation and Operation Manual (MH01) for more information.
2-06:	Relay #1 This point monitors the state of the drive's Relay #1 output. This point can be used to indicate various drive conditions as specified by Drive Parameter #54 (Relay #1). Refer to the MCH Installation and Operation Manual (MH01) for more information.
2-07:	Fault Condition This point indicates whether or not the drive is currently tripped on a fault. This point returns 0 (OK) if the drive is not in a fault condition or 1 (FAULT) if it is.
2-08:	Serial Watchdog This point indicates the state of the MCH drive's serial watchdog function. If Drive Parameter #57 (Serial) is set to WITH TIMER and Point 4-02 is set to NORMAL, then this point returns a value of 0 (ENABLED). If Drive Parameter #57 (Serial) is set to W/O TIMER or Point 4-02 is set to DISABLE, then this point returns a value of 1 (DISABLED).

4.4 Analog Output (AO) Point Descriptions

Point	Description
3-01:	Acceleration Rate This point sets the time that it will take for the drive to ramp up the motor from 0.00Hz to the value set in Drive Parameter #18 (Base Frequency). It sets the value in Drive Parameter 8 (Accel Rate). The maximum value for this point is 3600.0 seconds. The minimum value is either 0.1 sec, 0.3 sec or 0.6 sec depending on the horsepower of the drive. For the actual minimum boundary, refer to the MCH Installation and Operation Manual (MH01).
3-02:	Deceleration Rate This point sets the time that it will take for the drive to ramp down the motor from the value set in Drive Parameter #18 (Base Frequency) to 0.00Hz. It sets the value in Drive Parameter 9 (Decel Rate). The maximum value for this point is 3600.0 seconds. The minimum value is between 0.1 sec and 4.0 sec depending on the voltage rating and horsepower of the drive as well as the presence of a dynamic brake. For the actual minimum boundary, refer to the MCH Installation and Operation Manual (MH01).
3-03:	Source Select This point is used to set the HOA reference for the speed or setpoint command. A setting of NORMAL (0) will cause the drive to use the source that corresponds to the drive's current HOA status. If the HOA is HAND (or was HAND prior to an OFF condition), the drive will follow the source dictated by Drive Parameter #29 (Hand Source). If the HOA is AUTO (or was AUTO prior to an OFF condition) the drive will follow the source dictated by Drive Parameter #24 (Auto Source). A setting of HAND ONLY (1) will cause the drive to use the source dictated by Drive Parameter #29 (Hand Source) regardless of the drive's HOA status. A setting of AUTO ONLY (2) will cause the drive to use the source dictated by Drive Parameter #24 (Auto Source) regardless of the drive's HOA status. One use for this point is to allow the user to toggle between OPEN loop speed control and CLOSED loop PID control when PID mode is ENABLED (See Point 2-01). The ability to command this point through the N2 network is dictated by Drive Parameter #30 (Control) and the drive HOA (See Point 1-07). If this point is not being overridden, this value can also be set using the SPEED SOURCE and ENTER keys on the drive keypad. **NOTE:** If the SPEED SOURCE key on the drive keypad is currently changing the source selection, serial override commands of this point will not be accepted.
3-04:	Keypad Speed Command This point monitors and controls the Keypad Speed Command. The ability to command this point through the N2 Network is dictated by the setting of Drive Parameter #30 (Control) and the drive's current H/O/A Mode (Refer to Point 3-03). If this point is not being overridden, this value can also be set using the drive's MOP function or the UP and DOWN arrow keys on the drive keypad. **NOTE:** If the MOP function or the drive keypad is currently changing the keypad speed command, serial override commands of this point will not be accepted.

Point	Description
3-05:	Keypad Setpoint Command This point monitors and controls the Keypad Setpoint Command. The units for this point are defined by Drive Parameter #31 (Units). The minimum and maximum values for this point are defined by Drive Parameter #75 (Feedback @ Min) and #76 (Feedback @ Max), respectively. The range of adjustment for Drive Parameters #75 and 76 is –32768 to 32767. The ability to command this point through the N2 network is dictated by Drive Parameter #30 (Control) and the drive HOA (Refer to Point 3-03). If this point is not being overridden, this value can also be set using the drive's MOP function or the UP and DOWN arrow keys on the drive keypad. **NOTE:** If the MOP function or the drive keypad is currently changing the keypad setpoint command, serial override commands of this point will not be accepted.

4.5 Binary Output (BO) Point Descriptions

Point	Description
4-01:	Start/Stop Drive This point reflects the last serial START/STOP command that was issued to the drive.
4-02:	Disable Serial Watchdog This point is used to disable the drive's serial watchdog function. If this point is set to NORMAL, then the serial watchdog will be enabled or disabled depending upon the setting of Drive Parameter #57 (Serial). If this point is set to DISABLE then the serial watchdog is DISABLED.
4-03:	Clear Present Fault This point is used to clear the current fault via the serial link. Set this point to RESET (1) to clear the present fault. Once the fault has been cleared, the value of this point will automatically return to NORMAL (0).

4.6 Reference and Links

MCH Series Variable Frequency Drives visit:

http://www.lenze-actech.com

Metasys N2 and Johnson Controls, Inc. visit:

http://www.johnsoncontrols.com/publish/us/en/products/building_efficiency/building_management/metasys.html

Lenze AC Tech Corporation

630 Douglas Street • Uxbridge MA 01569 • USA
Sales: 800-217-9100 •Service: 508-278-9100
www.lenze-actech.com

RG-MHMET-e6