Lenze

SMD SERIES INVERTER

MODBUS CONTROL OPERATION MANUAL

Document: SLmod-e2

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1 Scope

This document is intended to define the specifics required for serial communication with the Lenze ***smd*** series drives for control, status monitoring, and programming parameters. A familiarity with normal drive capabilities and operations is assumed. If this is not the case, please refer to the ***smd*** instruction manual as necessary.

Only standard ***smd*** models with an "L" as the eighth digit in the model number (ex. ESMD371L4TXA) are equipped with Modbus RS-485 capabilities. When using this feature the drive can communicate with a personal computer (PC), programmable logic controller (PLC), or other external device that utilizes RS-485 serial communication for control or monitoring. RS-485 half-duplex interface allows up to 32 devices to communicate on the network using a twisted pair of wires. The wires must be terminated at both ends of the network with resistors equal to their characteristic impedance, typically 120Ω. In noisy environments, twisted and shielded wire should be used. Ground the shield at the drive end only. This will further reduce unwanted noise and improve overall communication reliability. In addition, grounding terminal 7 on the ***smd*** is recommended when using serial communications.

ATTENTION!

The smd was originally released with "Parameter Version" 400. The product feature set was increased with Parameter Version 507 to include set-point (PI) control, a second acceleration/ deceleration ramp, and other functionality.

The added functions created a change to the Modbus mapping as displayed in Table 2.

The "Parameter Version" for the smd is displayed for approximately 5 seconds following the initial application of power. For other Parameter Versions of the smd (special releases), please consult your Lenze sales office.

2 Modbus® Details

A) ***smd*** series drives running the Modbus communication protocol use the RTU (Remote Terminal Unit) transmission mode and are slaves only. Therefore, the device communicating with the drives must be a Modbus Master. The baud rate is 9600, no parity (two stop bits). There are provisions for No parity 1 stop bit (PV507), Odd parity 1 stop bit and Even parity 1 stop bit as well. The bit sequence is:

	DATA									
Start bit	1	2	3	4	5	6	7	8	Stop bit	Stop bit

B) At this time the ***smd*** series drive does not support the broadcast function of the protocol.

C) IMPORTANT NOTE: Modbus 3X and 4X Registers are numbered starting at 1. However, when transmitted to a slave over the serial link, the actual address transmitted is one less. This is because the addresses are numbered starting from 0. The ***smd*** register numbers are also numbered starting from 0. Therefore, ***smd*** register numbers always correspond exactly with the address transmitted. As a result, MODBUS REGISTER NUMBERS ARE ALWAYS ONE GREATER THAN THE ***smd*** REGISTER NUMBERS. WHENEVER THE WORDS "REGISTER #xx" APPEAR, IT SHOULD BE ASSUMED THAT THEY MEAN "***smd*** REGISTER xx" and the Modbus Register number will be one larger. In some instances we may show both for clarity. For example: "Register #24 (Modbus Register #25) . . ."

D) The function codes supported by the ***smd*** series are:

1) 03 - Read Holding Register (4X references). In general we can read only one word at a time. However, there are a few limited exceptions.

   Exception One:
   a) Register #24-29 can be read as a group (ie. as a 6 word read to register #24).

   Exception Two:
   b) Parameter C99 (Software version) is a 4 word read.
2) 04 - Read Input Register (3X references). As with function 03, we read one word at a time except where noted.
3) 06 - Preset Single Register (4X references). Write single register.
4) 16 - Preset Multiple Registers (4X references). Although the function is for multiple registers, we will accept only a single register to be written.
5) Note: Since we do not differentiate between 4X and 3X references, function codes 03 and 04 are treated identically.

E) Exception codes:

01 - Command rejected, Illegal function.
02 - No such register.
03 - Data out of range.
04 - Wrong data format.
06 - Slave device busy.

F) The ***smd*** will most nearly conform to the Modicon® Micro 84 in capabilities. This may be of importance when configuring networks for DDE Servers.

G) Modbus and Modicon are registered trademarks of Schneider Electric. For more information about the Modbus Protocol please refer to the Modicon Modbus Protocol Reference Guide. The 24 hours support telephone number from Schneider Electric is 1-800-468-5342.

3 Universal Registers

AC Technology Corp manufactures several drive families. Currently the QC Series, MC Series, SC series TC Series, and the Lenze ***smd*** and ***Tmd*** series support Modbus based communications. Since the six families of drives have quite different parameters and size ranges, the parameter (register) definitions are in many cases quite different. In order to facilitate communication in a network with a mix of drive types, certain Register locations have been made universal among AC Tech drives. While their locations are consistent, their contents may vary as defined in the following table:

Register #	Function
1	Drive Control (WRITE ONLY). Not all drives will have all control functions. But when the function is available it will be at a defined bit location within Register #1. Drive Family and register Configuration Number dependent.
19	Drive Family (READ ONLY). This register is CONSISTENT AMONG ALL AC TECH DRIVES: The ***smd*** value is 69
21	Drive Size (READ ONLY). Code to identify Power (HP/KW) and Line Voltage of the drive. Family dependent. The ***smd*** value is always zero.
22	Hardware Configuration word register (READ ONLY). Individual bit flags.
24	Drive Status (READ ONLY). Various operational variables.
48	Unlock Control (WRITE ONLY).
49	Unlock Writing of registers (WRITE ONLY).
50	Parameter Configuration Number (READ ONLY).

4 Data Internal and External Representation

A) All registers are 16 bits. The data within these registers can take on the following forms:

1) Individual bit commands (16 per register).
Example: Register #1 (Modbus Register #2).
2) Individual bit flags (16 per register).
Example: Register #22.
3) A concatenation of two 8 bit unsigned integers.
4) A 16 bit unsigned integer. This unsigned integer could in turn represent many different types of data with various scaling rules and units, which are defined by the DATA TYPE of the register.

B) Data Types

Data passed in registers across the Modbus communications link are always in INTERNAL units. The drive itself may show the information in alternate DISPLAYED units. For Example: drive speeds are always stored internally as tenths of a Hz but the drive may display that speed in whole Hz by dropping the tenth using programmed conversion factors. The Following are examples of the internal units used on the ***smd***:

Type	Unit	Example
SPEED	.1 Hz	100Hz = 1000
TIME	.1 Sec	30.0 Sec = 300

See Programming Parameter List

5 smd Parameters

Registers #0 through #50 (Modbus Registers #1 to #51) are reserved for configuration and Control. Registers #51 through #255 (Modbus Registers #52 to #256) are reserved for the Drives' Programming Mode Parameters. Programming Mode Parameters are the parameters that can be accessed from the local keypad on the drive. To find the register address for a particular parameter see Table 2 - Programming Parameter List.

The entries in Tables 1 and 2 are based on ***smd*** Parameter Configuration 400 (Drive software #1.51) and Parameter Configuration 507 (drive software #2.00 and #2.01). If a different revision of software were to change register definitions, drive operation could be seriously affected. This will be identified for a given drive by examining Register #50 (Parameter Configuration Number). The number displayed at power up on drive display can also identify it. If it is not 400 or 507, writing to any register on the drive MUST NOT BE ATTEMPTED unless your Controller has been setup to support the new configuration, please contact your Lenze sales office if this is the case.

6 smd Operational Details

A) In order to communicate using MODBUS protocol, the ***smd*** Control source setpoint parameter C01 must be set to one of the following values:

8 – MODBUS protocol. Drive is controlled via terminal programming and monitoring can be accomplished via MODBUS serial interface or keypad. Default speed source is set to be analog input.
9 – same as selection 8 but default speed source is set to c40.
10 – same as selection 8 but drive control is switched to serial.
11 – same as selection 9 but drive control is switched to serial..

B) Network Address – code C09. This parameter must be programmed prior to attempting to operate the serial interface.

C) Parameter c25 – If parameter C01 is set to 8…11 (MODBUS selected). Then the selections in code c25 have the following meaning:

0 = 9600,N,2
1 = 9600,N,1
2 = 9600,E,1
3 = 9600,O,1

Prior to attempting to communicate with the drive, Parameter c25 must be appropriately programmed.

D) Unlocking & Locking Controls

1) A write to Register #48 (Unlock Controls) with a value of 0 will unlock controls. This enables the writing of Register #1 – the Drive Control Register.

Note: Code C01 must be set to 10 or 11 in order to unlock serial control.

2) If Register #48 (Unlock Controls) is written with a value that is the Drive's Programming Password (C94), then in addition to Register #1(Drive Control), writing to all other writeable registers is enabled (e.g.: parameter C37 -- Preset Speed #1). The factory default password for the ***smd*** is 0.
3) Once Register #48 (Unlock Controls) has been written, Controls are unlocked until Register#1 bit 1 (Lock Bit) has been written, Code C01 is changed to value different than 10 or 11 or the drive is powered down.
4) Writing to Register #1 (Drive Control) with bit 1 set will Lock both Controls and Parameters (prevents writing to any register).
5) When LOCK is asserted, the drive drops out of SERIAL control. After receiving the WRITE message when serial control is locked, drive will return exception code 01.
6) Even though drive might be locked, and thus parameters and control cannot be written, parameters and status can always be read. See section (G) below.

E) Unlocking & Locking Programming Parameters only

1) Writing to any writeable register other than #1 can be enabled by writing the Drive's Programming Password (C94) to Register #49 (Unlock Parameters). This would be done when Drive Control (start, forward and reverse) is not required.
2) The Factory Default password is 0.
3) Once Register #49 (Unlock Parameters) has been written, the writing of parameter registers is unlocked until Register #1 bit 1 (Lock Bit) has been set.

F) Watchdog Timer

The ***smd*** is equipped with a Serial Link "Watchdog Timer". If the Modbus Master wishes to control the drive (start, stop, forward, reverse, etc.) it must first "Unlock Controls" (See "D" above). If the Watchdog Timer is enabled, the Master MUST PERIODICALLY COMMUNICATE with the drive or the timer will timeout.
Watchdog timer setup is performed by using parameters n22 and n23.
Code n22 is used to select drive reaction to serial timeout.

a) Selection 0 – Not active. Watchdog timer is disabled.
b) Selection 1 – Controller inhibit. If drive doesn't receive valid communication for period longer than time specified in parameter n23, it will coast to a stop and status display (c61) will show inhibit state 'Inh'.
c) Selection 2 – Quick Stop. If drive doesn't receive valid communication for period longer than time specified in parameter n23, it will ramp to a stop and status display (c61) will show stop state 'Stp'.
d) Selection 3 – Trip fault 'FC3'. If drive doesn't receive valid communication for period longer than time specified in parameter n23, it trips with an 'FC3' fault.

NOTE:

To prevent erroneous timeout trips, make sure the time set in parameter n23 is appropriate for particular network - default value of 50ms may be too restrictive!

WARNING:

Disabling the watchdog timer may cause injury to personnel and/or damage to equipment. The watchdog timer should only be disabled during configuration or diagnosis to prevent nuisance timeout trips.

G) Monitoring Only Operation

1) Power up drive
2) Set code C01 to selection 8 or 9.
3) Simply read ***smd*** Register #24 (Modbus Register #25) or any other readable register.
4) No unlocking or watchdog issues apply for monitoring.

H) Normal Control Operation Sequence.

1) Power up the drive.
2) Set code C01 to selection 10 or 11.
3) Close terminal 28.
4) Unlock control by writing a password (default 0) to Register #48.
5) Control drive operation via various commands to Register #1 (Start, Stop, Reverse direction, etc.).
6) Set the network speed reference by setting bit 8 in Register #1. Drive must be in "SERIAL SPEED REFERENCE" (see Register #1 [drive control]) in order to control speed via Register #40.
7) Control Drive Speed by writing the Speed Commands to Register #40 (Serial Speed Command).
8) If serial timeout is activated (parameter n22 higher than 0), keep it from timing out by assuring that repeated reads of drive status (Register #24 – 6 registers) are performed at reasonable intervals smaller than the time set in parameter n23.
9) Lock Control when drive operations are complete by writing a 2 to Register #1 (assert bit 1 of Register 1).

I) Start/Stop, Speed Control and Parameter Change Operation Typical Sequence.

1) Power up the drive.
2) Set code C01 to selection 10 or 11.
3) Close terminal 28.
4) Unlock Controls and Parameters by writing the current programming password (default 0) to Register #48.
5) Control Drive Operation via various commands to Register #1 (Start, Stop, Reverse direction, etc.).
6) Set the network speed reference by setting bit 8 in Register #1. Drive must be in "SERIAL SPEED REFERENCE" (see Register #1 [drive control]) in order to control speed via Register #40.
7) Control Drive Speed by writing the Speed Commands to Register #40 (Serial Speed Command).
8) Change the programming parameters (e.g., change the acceleration rate by writing new acceleration rate to register #61)
9) If serial timeout is activated (parameter n22 higher than 0), keep it from timing out by assuring that repeated reads of drive status (Register #24 – 6 registers) are performed at reasonable intervals smaller than the time set in parameter n23.
10) Lock Control when drive operations are complete by writing a 2 to Register #1 (assert bit 1 of Register 1).

TABLE 1 - *smd* Drive Control Registers

**See Note [1], for an explanation of the abbreviations used below.*

smd# *(HEX Value)*	**Register Name**	**R/W/RS**	**Message**								**MIN**	**MAX**	**Units**	**Note**
1 *(01)*	Drive Control	W	SA	06	00	01	DH	DL	CRCH	CRCL	See Notes			*[2]*
		RS	SA	06	00	01	DH	DL	CRCH	CRCL				
19 *(13)*	Drive Family	R	SA	03	00	13	00	01	CRCH	CRCL	See Notes			*[3]*
		RS	SA	03	02	00	45	CRCH	CRCL					
21 *(15)*	Drive Size	R	SA	03	00	15	00	01	CRCH	CRCL	See Notes			*[4]*
		RS	SA	03	02	00	00	CRCH	CRCL					
22 *(16)*	Drive H/W	R	SA	03	00	15	00	01	CRCH	CRCL	See Notes			*[5]*
		RS	SA	03	02	DH	DL	CRCH	CRCL					
24 *(18)*	Drive Status (6 register read) (reg. #24 to 29)	R	SA	03	00	18	00	06	CRCH	CRCL	See Notes			*[6]*
		RS	SA	03	0C	D1H	D1L	D2H	D2L					
						D3H	D3L	D4H	D4L					
						D5H	D5L	D6H	D6L					
								CRCH	CRCL					
24 *(18)*	Command Speed	R	SA	03	00	18	00	01	CRCH	CRCL	0	2400	0.1 Hz	*[6a]*
		RS	SA	03	02	DH	DL	CRCH	CRCL					
25 *(19)*	Actual Speed	R	SA	03	00	19	00	01	CRCH	CRCL	0	2400	0.1 Hz	*[6b]*
		RS	SA	03	02	DH	DL	CRCH	CRCL					
26 *(1A)*	Load (DH) / Status (DL)	R	SA	03	00	1A	00	01	CRCH	CRCL	See Notes			*[6c]*
		RS	SA	03	02	DH	DL	CRCH	CRCL					
27 *(1B)*	Act. Direction (DH)/ Control Mode (DL)	R	SA	03	00	1B	00	01	CRCH	CRCL	See Notes			*[6d]*
		RS	SA	03	02	DH	DL	CRCH	CRCL					
28 *(1C)*	Speed Source(DH)/ Speed Ref(DL)	R	SA	03	00	1C	00	01	CRCH	CRCL	See Notes			*[6e]*
		RS	SA	03	02	DH	DL	CRCH	CRCL					
29 *(1D)*	Fault (DH)/ Commanded Direction (DL)	R	SA	03	00	1D	00	01	CRCH	CRCL	See Notes			*[6f]*
		RS	SA	03	02	DH	DL	CRCH	CRCL					
30 *(1E)*	Motor Voltage	R	SA	03	00	1E	00	01	CRCH	CRCL	0	250	1%	*[7]*
		RS	SA	03	02	DH	DL	CRCH	CRCL					
40 *(28)*	Serial Speed Command	R	SA	03	00	28	00	01	CRCH	CRCL	C10 Min freq.	C11 Max freq.	0.1 Hz	*[8]*
		RS	SA	03	02	DH	DL	CRCH	CRCL					
		W	SA	06	00	28	DH	DL	CRCH	CRCL				
		RS	SA	06	00	28	DH	DL	CRCH	CRCL				
48 *(30)*	Unlock Commands	W	SA	06	00	30	DH	DL	CRCH	CRCL	0	999	None	*[9]*
		RS	SA	06	00	30	DH	DL	CRCH	CRCL				
49 *(31)*	Unlock Parameters	W	SA	06	00	31	DH	DL	CRCH	CRCL	0	999	None	*[10]*
		RS	SA	06	00	31	DH	DL	CRCH	CRCL				
50 *(32)*	Register Version	R	SA	03	00	32	00	01	CRCH	CRCL	0	65535	None	*[11]*
		RS	SA	03	02	DH	DL	CRCH	CRCL					

NOTES:

Note [1]: Following are the abbreviations used in TABLE 1 – smd Control Registers:

R	Read	
W	Write	
RS	Response	
SA	Slave Address (typically 01 through F7 hex)	
CRCH	CRC high byte	(see CRC calculations section in MODBUS manual)
CRCH	CRC low byte	
DH	Data High byte	
DL	Data Low byte	
smd#	***smd*** Register #	(Modbus Register numbers are 1 larger)

Note [2]: Register #1 (Drive Control):

Data Low Byte	0	UPDATE BUFFERS
	1	LOCK SECURITY
	2	STOP DRIVE (COAST TO STOP)
	3	START DRIVE
	4	Unused
	5	Unused
	6	SET REVERSE
	7	SET FORWARD
Data High Byte	8	SERIAL SPEED REFERENCE
	9	LOCAL SPEED REFERENCE
	10	
	11	
	12	
	13	
	14	
	15	

The appropriate bit is set to 1. For example, to stop the drive bit two is set (send 0004H). To start the drive send 0008H. Setting update buffers bit, enables to start the drive using downloaded data. Locking security disables the serial drive control and prevents any further writing to control or parameter registers.

IMPORTANT: During each write to Register #1 only one bit should be set in the drive control word. Drive responds to stop bit only, if more than 1 bit is set. If stop bit is not set, but more than 1 bit is set, drive responds with exception 04.

Note [3]: smd series drives always return 69 (45H).

Note [4]: On smd drives this register always read zero.

Note [5]: Register #22 (Drive hardware configuration)
Bits represent specific hardware configuration.

smd *Series Drive:*

BIT #	SETTINGS	MEANING
0	1	Not isolated drive (hot)
	0	Isolated
1	1	Reserved
	0	Reserved
2	1	OEM defaults present
	0	No OEM defaults
3	1	EPM Parameter version is different but compatible
	0	Either the parameter version of the EPM matches the current software or the EPM is not compatible. If incompatible then one of the following faults are responsible: CF (control fault), cF (incompatibility fault) or GF (data fault).

*All other bits (4-15) are unused at this time.

Note [6]: When reading parameter #24, the group of words requested can be either 1 or 6. This is an exception to the rule of being able to read only one register at a time. If 6 words are requested at parameter #24, the following will be returned:

6 Register read at #24

Command Speed	D1H D1L
Actual Speed	D2H D2L
Load	D3H
Operation Status	D3L
Rotational Direction	D4H
Control Mode	D4L
Speed Command Source	D5H
Speed Reference status	D5L
Present Fault	D6H
Command Rotation	D6L

Note [6a]: Command Speed (register #24 bytes D1H and D1L or Register #25)
- In tenths of a Hz.
- Most significant byte is first, followed by Least significant.
- Example: 02 01 in hex converts to 51.3 Hz in decimal.

Note [6b]: Actual Speed (register #24 bytes D2H and D2L or Register #25)
- In tenths of a Hz.
- Most significant byte is first, followed by Least significant.

Note [6c]: Load (register #24 byte D3H or Register #26 DH)

- In percent of full load.
- Example: 64 (one byte in hex) represents 100% drive load (in decimal).

Operational Status (register #24 byte D3L or Register #26 DL)

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
11	LOWER TRANSISTORS SWITCHING ON
12	OFF
13	INHIBIT

Note [6d]: Actual Rotational Direction (Register #24 byte D4H or Register #27 DH)

0	FORWARD
1	REVERSE

Control Mode (Register #24 byte D4L or Register #27 DL)

Control Mode	Speed Source	Control Source	Program Source
0	Analog	Terminal	Keypad
1	Code c40	Terminal	Keypad
2	Analog	Terminal	LECOM
3	LECOM	LECOM	LECOM
4	Analog	Terminal	Remote Keypad
5	Code c40	Terminal	Remote Keypad
6	Analog	Remote Keypad	Remote Keypad
7	Code c40	Remote Keypad	Remote Keypad
8	Analog	Terminal	Modbus
9	Code c40	Terminal	Modbus
10	Analog	Modbus	Modbus
11	Code c40	Modbus	Modbus

Note [6e]: Speed Command Source (Register #24 byte D5H or Register #28 DH)

0	ANALOG FREQ
1	PRESET c40
2	PRESET 1
3	PRESET 2
4	PRESET 3
5	MOP SPEED
6	SERIAL SPEED

Speed Reference Status (Register #24 byte D5L or Register #28 DL)

0	SERIAL SPEED REFERENCE
1	LOCAL SPEED REFERENCE

Note [6f]: Present Fault (Register #24 byte D6H of Register #29 DH)

0	NO FAULT
1	OUTPUT (TRANSISTOR) FAULT (“OC1”)
2	HIGH DRIVE TEMPERATURE (“OH”)
3	HIGH DC BUS VOLTAGE (“OU”)
4	LOW DC BUS VOLTAGE (“LU”)
5	THERMAL OVERLOAD (“OC6”)
6	CONTROL FAULT (“CF”)
7	EXTERNAL (“EEr”)
8	SERIAL COMMUNICATION FAILURE (“FC5”)
9	START ERROR (“LC”)
10	INTERNAL1 (EPM) (“F1”)
11	INTERNAL2 (“F2”)
12	INTERNAL3 (“F3”)
13	INTERNAL4 (“F4”)
14	INTERNAL5 (“F5”)
15	INTERNAL6 (“F6”)
16	INTERNAL7 (“F7”)
17	INTERNAL8 (“F8”)
18	INTERNAL9 (“F9”)
19	INTERNALo (“Fo”)
20	SINGLE PHASE FAULT (“SF”)
21	INCOMPATIBILITY FAULT (“cF”)
22	DYNAMIC BRAKE OVERHEATED (“dF”)
23	REMOTE KEYPAD FAULT (“JF”)
24	COMMUNICATION FAULT (“FC3”)
25	EARTH FAULT (“OC2”)
26	CONFIGURATION FAULT (“CFG”)

Commanded Rotational Direction (Register #24 byte D6L or Register #29 DL)

0	FORWARD
1	REVERSE

Note [7]: Register #30 - Motor Volts. Output voltage to the motor expressed as a percentage of nominal drive voltage.

Note [8]: Register #40 -- Serial Speed. This register enables the User to set the serial speed to a desired value.

- In tenths of a Hz.
- Most significant byte is first, followed by Least significant.
- CONTROL OF THE DRIVE SPEED VIA THE SERIAL LINK IS NORMALLY DONE USING THIS PARAMETER. This register can be written only after enabling parameter writes.
- To use this speed – speed reference must be set to SERIAL SPEED REFERENCE by setting bit 8 in control register #1

Note [9]: Register #48 (Unlock Commands) unlocks commands by using 0000 for the password. If the correct Programming mode password is entered then the appropriate programming parameters can also be accessed (see the full parameter protocol specification if access to programming parameters is required).

Note [10]: Register #49 (Unlock Parameters) unlocks Programming Parameters for writing when the proper Programming Password is entered. Whenever a parameter writing session (where #49 was activated) is to be ended, register #1 bit 1 (Lock Security) must be asserted. This disables the watchdog and prevents further write access to Parameter Registers.

Note [11]: Register Version is the number that identifies if the current version of software has any register changes relative to previous versions: a register has been added or deleted, a register’s min/max limits have changed, a register’s function has been changed, or a register’s default value has been changed. Generally it is the programming parameters that are changed. Typically the Control Registers (smd Register #1 through #50) remain unchanged.

7 smd Programming Parameters Details

The structure of the Modbus messages required to read or write to the programming parameters listed in Table 2 is as follows:

SA -- (1byte) drive address (1-247)

RA -- (1byte) register address

CRCH -- High byte of Cyclic Redundancy Check (see CRC calculation section on Modbus manual)

CRCL -- Low byte of Cyclic Redundancy Check

READING:

Message structure for reading 1 word: (most of parameters)

Request:	SA	03	00	RA	00	01	CRCH	CRCL
Response:	SA	03	02	DH	DL	CRCH	CRCL	

Message structure for reading 4 word: (Parameter C99 Software Version)

Request:	SA	03	00	RA	00	04	CRCH	CRCL
Response:	SA	03	08	D1H	D1L	D2H	D2L	D3H
		D3L	D4H	D4L	CRCH	CRCL		

Sample contents of received data bytes (D1..D4 → 'SMD 1.51')

WRITING:

Message structure for writing 1 word: (all writeable parameters)

Request:	SA	06	00	RA	DH	DL	CRCH	CRCL
Response:	SA	06	00	RA	DH	DL	CRCH	CRCL

TABLE 2 - Programming Parameter List

Parameter No.[1]	smd Register Address (hexidecimal value)		Parameter Name	Range of Adjustment[2] (values representing selection)	Factory Default
	smd PV400	smd PV507			
C01	51 *(33H)*	51 *(33H)*	Setpoint and Control Source	Speed Source / Control Source / Program Source 0 Analog / Terminal / Keypad 1 Code c40 / Terminal / Keypad 2 Analog / Terminal / LECOM 3 LECOM / LECOM / LECOM 4 Analog / Terminal / Remote key 5 Code c40 / Terminal / Remote key 6 Analog / Remote key / Remote key 7 Code c40 / Remote key / Remote key 8 Analog / Terminal / Modbus 9 Code c40 / Terminal / Modbus 10 Analog / Modbus / Modbus 11 Code c40 / Modbus / Modbus	0
C02	52 *(34H)*	52 *(34H)*	Load Lenze setting	0 No action/loading complete 1 Load 50 Hz Defaults **2 Load 60 Hz Defaults** **3 Load OEM Defaults** **4 Translate compatible epm** NOTE: to change, drive must be in OFF or Inhibit state	0

[1] Drives programming code number

[2] Selections in **bold** are for new smd models only

Parameter No.[1]	smd Register Address (hexidecimal value)		Parameter Name	Range of Adjustment[2] (values representing selection)	Factory Default
	smd PV400	smd PV507			
CE1 CE2 CE3	53 *(35H)* 54 *(36H)* 55 *(37H)*	53 *(35H)* 54 *(36H)* 55 *(37H)*	Configuration – digital inputs E1, E2, E3	1 Activate fixed setpoint 1 (JOG1) 2 Activate fixed setpoint 2 (JOG2) 3 DC Braking (DCB) 4 Direction of rotation 5 Quick stop 6 CW rotation 7 CCW rotation 8 UP 9 DOWN 10 TRIP set 11 TRIP reset **12 Accel/decel 2** **13 Deactivate PI** **14 Activate fixed PI setpoint 1** **15 Activate fixed PI Setpoint 2**	CE1 = 1 CE2 = 4 CE3 = 3
C08	57 *(39H)*	57 *(39H)*	Configuration - relay output	0 Ready 1 Fault 2 Motor is running 3 Motor is running – CW rotation 4 Motor is running – CCW rotation 5 Output frequency = 0 Hz 6 Frequency setpoint reached 7 Threshold (C17) exceeded 8 Current limit reached **9 Feedback within min/max alarm range** **10 Feedback outside min/max alarm range**	1
C09	58 *(3AH)*	58 *(3AH)*	Network address	1 – 247	1
C10	59 *(3BH)*	59 *(3BH)*	Minimum output frequency	0.0 – 240 Hz	0.0 Hz
C11	60 *(3CH)*	60 *(3CH)*	Maximum output frequency	7.5 – 240 Hz	50.0 Hz
C12	61 *(3DH)*	61 *(3DH)*	Acceleration time	0.0 – 999 sec	5.0 sec
C13	62 *(3EH)*	62 *(3EH)*	Deceleration time	0.0 – 999 sec	5.0 sec
C14	63 *(3FH)*	63 *(3FH)*	Operating mode	0 Linear with Auto Boost 1 Square law with Auto Boost 2 Linear with constant V_{min} boost 3 Square law with constant V_{min} boost	2
C15	64 *(40H)*	64 *(40H)*	V/f reference point	25.0 – 999 Hz	50.0 Hz
C16	65 *(41H)*	65 *(41H)*	V_{min} boost	0.0 – 40.0%	4.0%
C17	66 *(42H)*	66 *(42H)*	Frequency threshold	0.0 – 240 Hz	0.0 Hz
C18	67 *(43H)*	67 *(43H)*	Chopper frequency	0 4 kHz 1 6 kHz 2 8 kHz 3 10 kHz	2
C21	68 *(44H)*	68 *(44H)*	Slip compensation	0.0 – 40.0%	0.0%
C22	69 *(45H)*	69 *(45H)*	Current limit	30 – 150%	150%
C24	70 *(46H)*	70 *(46H)*	Accel boost	0.0 – 20.0%	0.0%
C31		71 *(47H)*	Analog Input Deadband	0 Deadband Enabled 1 Deadband Disabled	0

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[2] Selections in **bold** are for new smd models only

Parameter No.[1]	smd Register Address (hexidecimal value)		Parameter Name	Range of Adjustment[2] (values representing selection)	Factory Default
	smd PV400	smd PV507			
C34	71 *(47H)*	72 *(48H)*	Configuration – analog input	0 0…10 V 1 0…5 V 2 0…20 mA 3 4…20 mA 4 4…20 mA monitored	0
C36	72 *(48H)*	73 *(49H)*	Voltage - DC injection brake (DCB)	0.0 – 50.0%	4.0%
C37	73 *(49H)*	74 *(4AH)*	Fixed setpoint 1 (JOG1)	0.0 – 999	20.0 Hz
C38	74 *(4AH)*	75 *(4BH)*	Fixed setpoint 2 (JOG2)	0.0 – 999	30.0 Hz
C39	75 *(4BH)*	76 *(4CH)*	Fixed setpoint 3 (JOG3)	0.0 – 999	40.0 Hz
C46	78 *(4EH)*	79 *(4FH)*	Frequency setpoint	0.0 – 240 Hz	Read only
C50	79 *(4FH)*	80 *(50H)*	Output frequency	0.0 – 240 Hz	Read only
C52	80 *(50H)*	82 *(52H)*	Motor voltage	0 – 255 %	Read only
C53	81 *(51H)*	83 *(53H)*	DC bus voltage	0 – 255%	Read only
C54	82 *(52H)*	84 *(54H)*	Motor current	0 – 255%	Read only
C56	83 *(53H)*	85 *(55H)*	Drive load	0 – 255%	Read only
C59		86 *(56H)*	PI Actual Feedback	c86 - c87	Read only
C70		89 *(59H)*	PI Proportional Gain	0 - 99.9%	5.0%
C71		90 *(5AH)*	PI Integral Gain	0 - 99.9 sec	0.0 sec
C90	86 *(56H)*	92 *(5CH)*	Input voltage selection	0 Auto 1 Low 2 High	0
C94	88 *(58H)*	94 *(5EH)*	User password	0 - 999	0
C99	89 *(59H)*	95 *(5FH)*	Software version	Read 4 words (format 'SMD 1.51')	Read only
c01		96 *(60H)*	Accel Rate 2	0.0 – 999 sec	5.0 sec
c03		97 *(61H)*	Decel Rate 2	0.0 – 999 sec	5.0 sec
c06	90 *(5AH)*	98 *(62H)*	Holding time – automatic DC injection brake	0.0 – 999 sec	0.0 sec
c08	91 *(5BH)*	99 *(63H)*	Analog output scaling	1.0 – 999	100.0
c11	92 *(5CH)*	100 *(64H)*	Configuration – analog output (62)	0 None 1 Output frequency 0-10 V 2 Output frequency 2-10 V 3 Load 0-10 V 4 Load 2-10 V 5 Dynamic Braking	0
c17	93 *(5DH)*	101 *(65H)*	Configuration – digital output (A1)	0 Ready 1 Fault 2 Motor is running 3 Motor is running – CW rotation 4 Motor is running – CCW rotation 5 Output frequency = 0 Hz 6 Frequency setpoint reached 7 Threshold (C17) exceeded 8 Current limit reached **9 Feedback within min/max alarm range** **10 Feedback outside min/max alarm range**	0

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Parameter No.[1]	smd Register Address (hexidecimal value)		Parameter Name	Range of Adjustment[2] (values representing selection)	Factory Default
	smd PV400	**smd PV507**			
c20	94 *(5EH)*	102 *(66H)*	I^2t switch-off	30 – 100 %	100 %
c25	95 *(5FH)*	103 *(67H)*	LECOM baud rate	0 9600 bps (9600,8,N,2 if C01 = 8…11) 1 4800 bps (9600,8,N,1 if C01 = 8…11) 2 2400 bps (9600,8,E,1 if C01 = 8…11) 3 1200 bps (9600,8,O,1 if C01 = 8…11)	0
c38		105 *(69H)*	PI Actual Setpoint	c86 - c87	Read only
c40	97 *(61H)*	106 *(6AH)*	Frequency setpoint command	0.0 – 240 Hz	0.0 Hz
c42	98 *(62H)*	107 *(6BH)*	Start condition	0 Start after LOW-HIGH change at 28 1 Auto start if 28 = HIGH	1
c60		109 *(6DH)*	Mode Select for c61	0 Monitor Only 1 Monitor and Edit	0
c61	100 *(64H)*	110 *(6EH)*	Present fault	Status/error message (see table 3)	Read only
c62	101 *(65H)*	111 *(6FH)*	Last fault	Error message (see table 3)	Read only
c63	102 *(66H)*	112 *(70H)*	Last but one fault	Error message (see table 3)	Read only
c70	103 *(67H)*	113 *(71H)*	Configuration – TRIP reset	0 TRIP reset by LOW-HIGH signal at 28 or mains switching or LOW-HIGH signal at digital input “TRIP reset” 1 Auto TRIP reset	0
c71	104 *(68H)*	114 *(72H)*	Auto TRIP reset delay	0.0 – 60.0 sec	0.0 sec
c78	105 *(69H)*	115 *(73H)*	Operating time counter		Read only
c79	106 *(6AH)*	116 *(74H)*	Mains connection time counter		Read only
c81		117 *(75H)*	PI Setpoint	c86 - c87	0.0
c82		118 *(76H)*	S-ramp Integral time	0.0 - 50.0 sec	0.0 sec
c86		119 *(77H)*	PI Min Feedback	0.0 - 999.0	0.0
c87		120 *(78H)*	PI Max Feedback	0.0 - 999.0	100.0
d25		123 *(7BH)*	PI Setpoint Accel/Decel	0.0 - 999.0 sec	5.0 sec
d38		124 *(7CH)*	PI Enable	0 PI Disabled 1 PI Enabled - Normal Acting 2 PI Enabled - Reverse Acting	0
d46		125 *(7DH)*	PI Min Alarm	0.0 - 999.0	0.0
d47		126 *(7EH)*	PI Max Alarm	0.0 - 999.0	0.0
n20	113 *(71H)*	131 *(83H)*	LECOM power up state	0 Quick stop 1 Inhibit	0
n22	114 *(72H)*	132 *(84H)*	Serial time out action	0 Not active 1 Controller inhibit 2 Quick stop 3 Trip fault “FC3”	0
n23	115 *(73H)*	133 *(85H)*	Serial fault time	50 – 65535 ms	50 ms

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TABLE 3: Fault Messages

0	NO FAULT
1	OUTPUT (TRANSISTOR) FAULT (“OC1”)
2	HIGH DRIVE TEMPERATURE (“OH”)
3	HIGH DC BUS VOLTAGE (“OU”)
4	LOW DC BUS VOLTAGE (“LU”)
5	THERMAL OVERLOAD (“OC6”)
6	CONTROL FAULT (“CF”)
7	EXTERNAL (“EEr”)
8	SERIAL COMMUNICATION FAILURE (“FC5”)
9	START ERROR (“LC”)
10	INTERNAL1 (EPM) (“F1”)
11	INTERNAL2 (“F2”)
12	INTERNAL3 (“F3”)
13	INTERNAL4 (“F4”)
14	INTERNAL5 (“F5”)
15	INTERNAL6 (“F6”)
16	INTERNAL7 (“F7”)
17	INTERNAL8 (“F8”)
18	INTERNAL9 (“F9”)
19	INTERNALo (“Fo”)
20	SINGLE PHASE FAULT (“SF”)
21	INCOMPATIBILITY FAULT (“cF”)
22	DYNAMIC BRAKE OVERHEATED (“dF”)
23	REMOTE KEYPAD FAULT (“JF”)
24	COMMUNICATION FAULT (“FC3”)
25	EARTH FAULT (“OC2”)
26	CONFIGURATION FAULT (“CFG”)