To: LFEV-ESCM Team

From: Ben Richards

Date: 22 February 2014

Subject: TDK-Lambda GENH30-25 Power Supply Remote Control over RS-232

Abstract:

The TDK-Lambda GENH30-25 Power Supply provides charging current for a single battery pack. It may be controlled directly by the front panel knobs and buttons, or remotely via an RS-232 command set. This remote control functionality can be useful as part of our proposed "Plug and Play" charging scheme.

Technical Findings:

The GENH30-25 as provided in the 2013 LFEV-ESCM system can communicate via RS-232/RS-485 on the RJ-45 port located on the rear of the unit. RS-232 is the familiar single-ended, point-to-point communication protocol used in several previous ECE courses. RS-485 is a separate protocol used for downstream communication with other power supplies. It uses differential-pair signalling on a bus topology, and is not of particular interest to us, as we cannot charge a pack at a rate higher than our single power supply can provide, and are therefore not chaining power supplies together.

A special cable (GEN/232-9) is required to connect the power supply to a host device. A "bare-bones" signalling method is implemented using only three wires: Tx, Rx, and common ground. On the rear of the power supply there are two RJ-45 jacks, labelled "IN" and "OUT". (They are physically identical to standard Ethernet jacks, but electrically incompatible.) The specified cable should be plugged into the jack labelled "IN" and to the host device.

I used a Windows 7 PC running RealTerm 2.0.0.70 to communicate via RS-232. The attached document is excerpted from the complete user's manual, and contains the API used to interact with the power supply. I experienced good results at 9600 and 19.2k baud rates using both short (6ft) and long (15 ft) cables.

Recommendations and Decisions:

I recommend the design team to utilize the remote control features of this GENH30-25 power supply as part of the battery pack charging sequence. If we want to support both maximum flexibility and maximum autonomy of the system, it will be important to tailor the charge input limits to suit the pack at hand, both for safety and efficiency.

Attached Documents And Useful Information:

Chapter 7, "TECHNICAL MANUAL FOR GENESYS 750W HALF RACK Programmable DC Power Supplies", Document 83-507-5002 Rev B (18 pages)

CHAPTER 7 RS232 & RS485 REMOTE CONTROL

7.1 INTRODUCTION

This Chapter describes the operation of the Genesys™ 3300W power supplies via the serial communication port. Details of the initial set-up, operation via RS232 or RS485, the command set and the communication protocol are described in this Chapter.

7.2 CONFIGURATION

7.2.1 Default setting

The power supply is shipped with the following settings:

-Address	6	-Output	Off
-Baud-rate	9600	-Start up mode	Safe-start
-RS232/485	RS232	-OVP	Maximum
-Vout setting	0	-UVL	0
-Iout setting	Maximum	-Foldback	Off
-Master/Slave	H1 (Master)	-Front panel:	Unlocked (UFP)

7.2.2 Address setting

The power supply address can be set to any address between 0 and 30. Follow the instructions described below to set the unit address.

1. If the unit is in Remote mode (front panel REM/LOC LED illuminated), press the REM/LOC button to put the unit into Local mode.
2. Press and hold for the REM/LOC button for approximately 3 sec. The VOLTAGE display will indicate the unit address.
3. Using the VOLTAGE adjust encoder, select the unit address.

To preview the power supply address at any time, press and hold the REM/LOC button for approx. 3 sec. The VOLTAGE display will indicate the power supply address.

7.2.3 RS232 or RS485 selection

To select between RS232 or RS485 set the rear panel setup switch SW1-6 position to:
-DOWN for RS232
-UP for RS485

7.2.4 Baud Rate setting

Five optional Baud rates are possible: 1200, 2400, 4800, 9600 and 19200. To select the desired rate, the following steps should be taken:

1. If the unit is in Remote mode (front panel REM/LOC LED illuminates), press REM/LOC button to put the unit into Local mode.
2. Press and hold the REM/LOC button for approximately 3 sec. The CURRENT display will show the unit Baud Rate.
3. Using the CURRENT adjust encoder, select the desired Baud Rate.

7.2.5 Setting the unit into Remote or Local mode

1. The unit will be put into Remote mode only via serial communication command. Commands that will put the unit into Remote mode are:

   RST PV n
   OUT n PC n
   RMT n
   (for n values see Tables 7-5 and 7-7)

2. There are two Remote modes:
   1. Remote: In this mode, return to local can be made by the front panel REM/LOC or via serial port command RMT 0. Set the unit into Remote mode via serial port RMT 1 command.

   2. Local Lockout: In this mode the unit can be returned to Remote mode via the serial port RMT 1 command or by turning off the AC power until the display turns off, and then turn it to on again. In local Lockout mode, the front panel REM/LOC button is not active. Set the unit into Local Lockout mode via serial port RMT 2 command.

7.2.6 RS232/RS485 port in Local mode

When the power supply is in Local mode, it can receive queries or commands. If a query is received, the power supply will reply and remain in Local mode. If a command that affects the output is received, the power supply will perform the command and change to Remote mode.
Serial commands may be sent to set the status registers and read them while the unit is in Local mode. If the Enable registers are set (refer to Section 7.11) the power supply will transmit SRQ's while in Local.

7.2.7 Front panel in Remote mode

Front panel control in Remote mode is Disabled except for:

1. PREV: use to preview the Voltage and Current setting.
2. OVP/UVL: use to preview the OVP/UVL setting.
3. LOC/REM: use to set the unit into Local mode.

In Local Lockout mode, only the PREV and OVP/UVL pushbuttons are active.

7.3 REAR PANEL RS232/RS485 CONNECTOR

The RS232/RS485 interface is accessible through the rear panel RS232/RS485 IN and RS485 OUT connectors. The connectors are 8 contact RJ-45. The IN and OUT connectors are used to connect power supplies in a RS232 or RS485 chain to a controller. Refer to Fig. 7-1 for IN/OUT connectors.

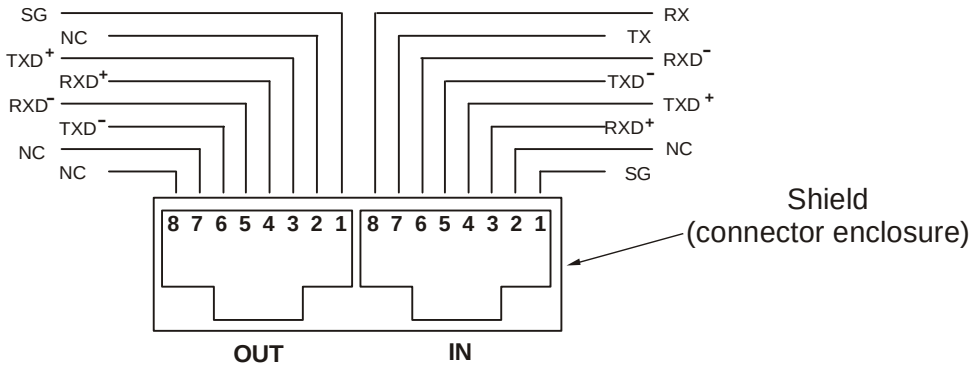


Fig.7-1: Rear panel J3 IN/OUT connectors pinout

NOTE

Tx and Rx are used for RS232 communication. Txd +/- and Rxd +/- are used for RS485 communication. Refer to RS-232 and RS-485 cabling and connection details.

7.4 MD MODE OPTION (Factory Installed)

7.4.1 MD Mode Description

The GEN supply is capable of operating in a multi drop environment - more than 1 supply conducting serial communications on a single serial bus. A maximum of 31 GEN supplies can operate in this single bus. Upon power up the Gen will enter the point-to-point mode in which it is assumed that only 1 supply will operate on a serial bus. MD Mode must be enabled - Ref. Section 7.10.2.2. The user must set all Slave supplies to a unique address. No two supplies may have the same address.

7.4.2 MD Mode enable – Serial communication mode

Refer to section 7.10.2.2. MD Mode is entered into via a Single byte command. In MD Mode the Master supply shall operate in one of the two serial modes, RS232 or RS485, depending upon the rear panel DIP switch setting and the Slave supplies shall operate in the RS485 serial mode.

7.4.3 MD Mode SRQ

In MD Mode the SRQ generated by the supply is replaced by a single byte SRQ sent two times in sequence. The SRQ byte, in binary, will contain the address of the supply in the least significant 5 bits with bits 5 and 6 set to logic zero and bit 7 set to logic 1. Ref. Table 7-4.

7.4.4 Communication Collisions

In MD Mode it is possible to have one supply issue an SRQ while another supply is transmitting data/response to a command. When this happens, the HOST PC will receive garbled data and assume that the data/response was corrupted and thus re-send the command - the SRQ will probably be lost. The method of recovery will be SRQ retransmission, Ref. Section 7.4.5, or polling all attached supplies to see who issued the SRQ - available by reading the SEVE? Register.

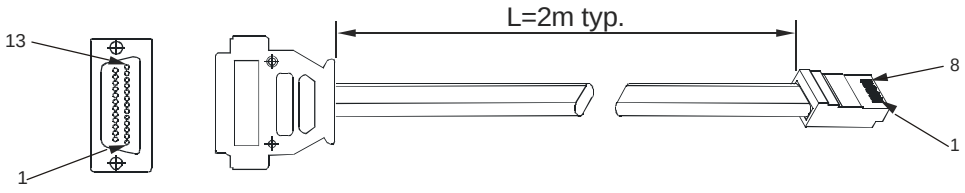
7.4.5 MD Mode SRQ Retransmission

The supply can be commanded to retransmit the SRQ at regular intervals until it is answered to by the HOST PC (Ref. Section 7.10.2.4). The retransmission interval is 10 ms plus the supply address multiplied by 20 ms.

7.5 CONNECTING POWER SUPPLIES TO RS232 OR RS485 BUS

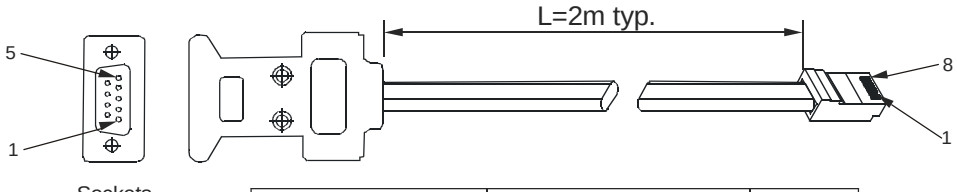
7.5.1 Single power supply

1. Select the desired interface RS232 or RS485 using rear panel setup switch SW1-6 (Section 4-4).
   -RS232: DOWN position
   -RS485: UP position
2. Connect rear panel IN connector to the controller RS232 or RS485 port using a suitable shielded cable. Refer to Figures 7-2, 7-3 and 7-4 for available RS232 and RS485 cables.



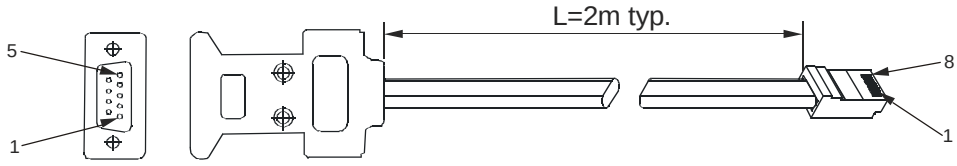
DB-25 CONNECTOR		8 PIN CONNECTOR		REMARKS
PIN NO.	NAME	PIN NO.	NAME	
1	SHIELD		SHIELD	
2	TX	8	RX	TWISTED
3	RX	7	TX	PAIR
7	SG	1	SG	

Fig.7-2: RS232 cable with DB25 connector (P/N: GEN/232-25)



DB-9 CONNECTOR		8 PIN CONNECTOR		REMARKS
PIN NO.	NAME	PIN NO.	NAME	
HOUSING	SHIELD	HOUSING	SHIELD	
2	RX	7	TX	TWISTED
3	TX	8	RX	PAIR
5	SG	1	SG	

Fig.7-3: RS232 cable with DB9 connector (P/N: GEN/232-9)



DB-9 CONNECTOR		8 PIN CONNECTOR		REMARKS
PIN NO.	NAME	PIN NO.	NAME	
HOUSING	SHIELD	HOUSING	SHIELD	
9	TXD -	6	RXD -	TWISTED
8	TXD +	3	RXD+	PAIR
1	SG	1	SG	
5	RXD -	5	TXD -	TWISTED
4	RXD +	4	TXD +	PAIR

Fig.7-4: RS485 cable with DB9 connector (P/N: GEN/485-9)

7.5.2 Multi power supply connection to RS232 or RS485 bus

Up to 31 units can be connected (daisy chained) to the RS232 or RS485 bus. The first unit connects to the controller via RS232 or RS485 and the other units are connected via the RS485 bus.

1. First unit connection: Refer to Section 7.5.1 for connecting the first unit to the controller.
2. Other units connection: The other units on the bus are connected via their RS485 interface. Refer to Figure 7-5 for typical connection.
   - Set rear panel setup switch SW1-6 to its UP position.
   - Using the Linking cable supplied with each unit (refer to Fig. 7-6), connect each unit OUT connector to the next unit IN connector.

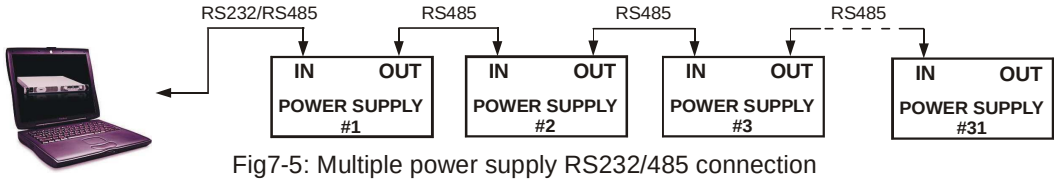
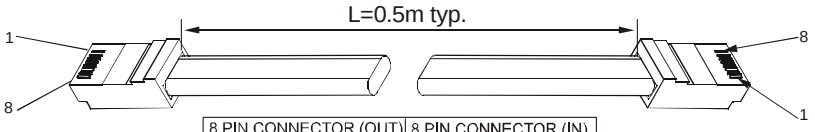


Fig7-5: Multiple power supply RS232/485 connection



8 PIN CONNECTOR (OUT)		8 PIN CONNECTOR (IN)	
PIN NO.	NAME	PIN NO.	NAME
HOUSING	SHIELD	HOUSING	SHIELD
1	SG	1	SG
6	TXD −	6	RXD −
3	TXD +	3	RXD +
5	RXD −	5	TXD −
4	RXD +	4	TXD +

Fig.7-6: Serial link cable with RJ-45 shielded connectors (P/N: GEN/RJ-45)

7.6 COMMUNICATION INTERFACE PROTOCOL

NOTE

The address (ADR n) command must return an “OK” response before any other commands are accepted.

7.6.1 Data format

Serial data format is 8 bit, one start bit and one stop bit. No parity bit.

7.6.2 Addressing

The Address is sent separately from the command. It is recommended to add 100msec delay between query or sent command to next unit addressing. Refer to Section 7.8.3 for details.

7.6.3 End of Message

The end of message is the Carriage Return character (ASCII 13). The power supply ignores the Line Feed (ASCII 10) character.

7.6.4 Command Repeat

The backslash character “\” will cause the last command to be repeated.

7.6.5 Checksum

The user may add a checksum (optional) to the end of the command. The checksum is “$” followed by two hex characters. If a command or a query has a checksum, the response will also have one. There is no CR between the command string and the “$” sign.

Example: STT?3A
STAT?$7B

7.6.6 Acknowledge

The power supply acknowledges received commands by returning an “OK” message. If an error is detected the power supply will return an error message. The rules of checksum also apply to the acknowledge.

7.6.7 Error message

If an error is detected in command or query, the power supply will respond with an error message. Refer to Section 7.7 for details.

7.6.8 Backspace

The backspace character (ASCII 8) clears the last character sent to the power supply.

7.7 ERROR MESSAGES

The power supply will return error messages for illegal commands and illegal programming parameters. Refer to Table 7-1 for programming error messages and Table 7-2 for command error messages.

Table 7-1: Programming error messages

Error Code	Description
E01	Returned when program voltage (PV) is programmed above acceptable range. Example: PV above ‘105% of supply rating’ or PV above 95% of OVP setting’.
E02	Returned when programming output voltage below UVL setting.
E04	Returned when OVP is programmed below acceptable range. Example: OVP less than “5% of supply voltage rating’ plus ‘voltage setting’.
E06	Returned when UVL is programmed above the programmed output voltage.
E07	Returned when programming the Output to ON during a fault shut down.

Table 7-2: Commands error messages

Error Code	Description
C01	Illegal command or query
C02	Missing parameter
C03	Illegal parameter
C04	Checksum error
C05	Setting out of range

7.8 COMMAND SET DESCRIPTION

7.8.1 General guide

1. Any command or argument may be in capital letters or small letters.
2. In commands with an argument, a space must be between the command and the argument.
3. For any command that sets a numeric value, the value may be up to 12 characters long.
4. Carriage Return: If the CR character (ASCII 13) is received by itself, the power supply will respond with “OK” and CR.

7.8.2 Command set categories

1. Initialization control
2. ID control
3. Output control
4. Status control

7.8.3 Initialization Control Commands

#	Command	Description
1	ADR n	ADR is followed by address, which can be 0 to 30 and is used to access the power supply.
2	CLS	Clear status. Sets FEVE and SEVE registers to zero (refer to Section 7-11).
3	RST	Reset command. Brings the power supply to a safe and known state: Output voltage: zero, Remote: non-lockout remote, Output current: zero, Auto-start: Off, Output: Off, OVP: maximum, FOLD: Off, UVL: zero The conditional registers (FLT and STAT) are updated, the other registers are not changed.
4	RMT	Sets the power supply to local or remote mode: 1. RMT 0 or RMT LOC, sets the power supply into Local mode. 2. RMT 1 or RMT REM, sets the unit into remote mode. 3. RMT 2 or RMT LLO, sets the unit into Local Lockout mode (latched remote mode).
5	RMT?	Returns to the Remote mode setting: 1. "LOC" - The unit is in Local mode. 2. "REM" - The unit is in Remote mode. 3. "LLO" - The unit is in Local Lockout (latched remote) mode.
6	MDAV?	Returns MD MODE OPTION Status. 1 indicates installed and 0 indicates not installed.
7	\	Repeat last command. If \<CR> is received, the power supply will repeat the last command.

7.8.4 ID Control Commands

#	Command	Description
1	IDN?	Returns the power supply model identification as an ASCII string:LAMBDA, GENX-Y
2	REV?	Returns the software version as an ASCII string.
3	SN?	Returns the unit serial number. Up to 12 characters.
4	DATE?	Returns date of last test. Date format: yyyy/mm/dd

7.8.5 Output Control Commands

#	Command	Description
1	PV n	Sets the output voltage value in Volts. The range of voltage value is described in Table 7-5. The maximum number of characters is 12. See the following examples for PV n format: PV 12, PV 012, PV 12.0, PV 012.00, etc…
2	PV?	Reads the output voltage setting. Returns the string "n" where "n" is the exact string sent in the PV n command. When in Local mode, returns the PREVIEW (front panel) settings in a 5 digit string.
3	MV?	Reads the actual output voltage. Returns a 5 digits string. Example: 60V supply sends 01.150, 15.012, 50.000, etc…
4	PC n (See Note 1)	Set the Output Current value in Amperes. The range of current values is described in Table 7.6. The maximum number of characters is 12. See the following examples for PC n format: PC n format: PC 10, PC 10.0, PC 010.00, etc…
5	PC?	Reads the Output Current setting. Returns the string "n" where "n" is the exact string sent in the PC n command. When in Local mode, returns the PREVIEW (front panel) settings in a 5 digit string.

6	MC? (See Note 2)	Reads the actual Output Current. Returns a 5 digit string. Example: 200A supply sends 000.50, 110.12, 200.00, etc…
7	DVC?	Display Voltage and Current data. Data will be returned as a string of ASCII characters. A comma will separate the different fields. The fields, in order, are: Measured Voltage, Programmed Voltage, Measured Current, Programmed Current, Over Voltage Set Point and Under Voltage Set Point. Example: 5.9999,6.0000,010.02,010.00,7.500,0.000
8	FILTER nn	Set the low pass filter frequency of the A to D Converter for Voltage and Current Measurement where nn = 18, 23 or 46.
9	FILTER?	Returns the A to D Converter filter frequency: 18,23 or 46 Hz.
10	OUT n	Turns the output to ON or OFF. Recover from Safe-Start, OVP or FLD fault. OUT 1 (or OUT ON)-Turn On. OUT 0 (or OUT OFF)-Turn Off
11	OUT?	Returns the output On/Off status string. ON - output On. OFF - output Off.
12	FLD n	Sets the Foldback protection to ON or OFF. FLD 1 (or FOLD ON) - Arms the Foldback protection FLD 0 (or FOLD OFF) - Cancels the Foldback protection. When the Foldback protection has been activated, OUT 1 command will release the protection and re-arm it, while FLD 0 will cancel the protection.
13	FLD?	Returns the Foldback protection status string: “ON” - Foldback is armed. “OFF” - Foldback is cancelled.
14	FBD nn	Add (nn x 0.1) seconds to the Fold Back Delay. This delay is in addition to the standard delay. The range of nn is 0 to 255. The value is stored in eprom at AC power down and recovered at AC power up.
15	FBD ?	Supply returns the value of the added Fold Back Delay.
16	FBDRST	Reset the added Fold Back Delay to zero.
17	OVP n	Sets the OVP level. The OVP setting range is given in Table 7-7. The number of characters after OVP is up to 12. The minimum setting level is approximately 105% of the Output Voltage setting, or the value in Table 7-7, whichever is higher. The maximum OVP setting level is shown in Table 5-1. Attempting to program the OVP below this level will result in an execution error response (“E04”). The OVP setting stays unchanged.
18	OVP?	Returns the setting “n” where “n” is the exact string in the user’s “OVP n”. When in Local mode, returns the last setting from the front panel in a 4 digit string.
19	OVM	Sets OVP level to the maximum level. Refer to Table 7-7.
20	UVL n	Sets Under Voltage Limit. Value of “n” may be equal to PV setting, but returns “E06” if higher. Refer to Table 7-8 for UVL programming range.
21	UVL?	Returns the setting “n” where “n” is the exact string in the user’s “UVL n”. When in Local mode, returns the last setting from the front panel in a 4 digit string.
22	AST n	Sets the Auto-restart mode to ON or OFF. AST 1 (or AST ON): Auto restart On. AST 0 (or AST OFF): Auto restart Off.
23	AST?	Returns the string auto-restart mode status.
24	SAV	Saves present settings. The settings are the same as power-down last setting. These settings are erased when the supply power is switched Off and the new “last settings” are saved.

25	RCL	Recalls last settings. Settings are from the last power-down or from the last "SAV" command.
26	MODE?	Returns the power supply operation mode. When the power supply is On (OUT 1) it will return "CV" or "CC". When the power supply is OFF (OUT 0 or fault shutdown) it will return "OFF".
27	MS?	Returns the Master/Slave setting. Master: n= 1, 2, 3, or 4 Slave: n=0

NOTES:
1. In Advanced parallel mode (refer to Sec. 5.15.2), "n" is the total system current.
2. In Advanced parallel mode, "MC?" returns the Master unit current multiplied by the number of slave units +1.

7.9 GLOBAL OUTPUT COMMANDS

7.9.1 GENERAL

All supplies, even if not the currently addressed supply, receiving a global command will execute the command. No response to the PC issuing the command will be returned to the PC. The PC issuing the command will be responsible to delay and any other communications until the command is execute. 200 Ms minimum is the suggested delay.
If the command contains an error, out of range values for example, no error report will be sent to the issuing PC.

Table 7-3

GRST	Reset. Brings the power supply to a safe and known state: Output voltage: 0V, output current: 0A, OUT: Off, Remote: RMT 1, AST: Off OVP: Max, UVL: 0. The conditional register (FLT and STAT) are updated. Other registers are *not* changed. Non-Latching faults (FB, OVP, SO) are cleared, OUT fault stays
GPV n	Sets the output voltage value in volts. The range of voltage values is shown in Table 7-5. 'n' may be up to 12 char plus dec. pt
GPC n	Program the output current value in amperes. The range of current values is shown in Table 7-6. 'n' may be up to 12 char plus dec. pt
GOUT	Turns the output to ON or OFF: "OUT 1/ON" = turn on "OUT 0/OFF" = turnoff, clears CV and CC bits in the Status Condition (STAT). OUT ON will respond with "E07' if the output cannot be turned on because of a latching fault (OTP< AC, ENA, SO) shutdown.
GSAV	Save present settings. Same settings as power-down last settings listed in Error! Reference source not found. Except the address and Baud rate are not saved Saves to the RAM. These settings are erased when the supply power is switched off and the new 'last settings' are saved.
GRCL	Recall last settings. Settings are from last power-down or from last 'SAV' or 'GSAV' command. Address and Baud rate are not recalled so communication is not interrupted.

7.10 SINGLE BYTE COMMANDS

7.10.1 General

Single byte commands are commands in which all the necessary data for the supply to act upon is contained in a single byte. Single byte commands will be executed immediately by the supply. If the command requires data to be sent to the HOST PC or IEEE Board (see sections 7.10.4 and 7.10.3.1) that response will be transmitted immediately with no delay due to any software overhead. With the exception of the Disconnect from communications command, section 7.10.3.1, commands must be sent by the HOST PC or IEEE Board 2 times in sequence for verification. Alll have the most significant bit, D7, set to a logic 1. A CR, carriage return, character is not included in a single byte command. The RST command will not change any setting made by a single byte command.
All Single Byte commands will be executed in 1 ms or less. This does not include any response sent to the HOST/IEEE Board, which is dependent upon the response length and the serial transmission speed (Baud rate).

7.10.2 Global commands without response

7.10.2.1 Disable MD Mode (MD MODE OPTION REQUIRED)

Disable is the default condition upon power up. The Hex value of the command is 0xA0. Send it two times in sequence. All supplies, both the currently addressed supply and all non-addressed supplies, will disable MD Mode as a result of this command.

7.10.2.2 Enable MD Mode (MD MODE OPTION REQUIRED)

Send to enable Multi Drop Mode. The Hex value of the command is 0xA1. Sent it two times in sequence. When this command is sent, the supply will set SRQ retransmission to the disable state; if you wish it to be enabled you must send the enable command. All supplies, both the currently addressed supply and all non-addressed supplies, will enable MD Mode as a result of this command.

7.10.2.3 Disable SRQ retransmission (MD MODE OPTION REQUIRED)

Disable is the default condition upon power up. The Hex value of the command is 0xA2. Sent it two times in sequence. If the supply sends an SRQ it will only sent it 1 time. All supplies, both the currently addressed supply and all non-addressed supplies, will disable SRQ retransmission as a result of this command. All status registers will retain their data when this command is sent.

7.10.2.4 Enable SRQ retransmission (MD MODE OPTION REQUIRED)

Enable retransmission of SRQs. This is only available when the Multi Drop Mode is enabled in the supply. The Hex value of the command is 0xA3. Send it two times in sequence. If the supply sends an SRQ it will be repeated on a timely basis, 10 ms plus 20 ms times the supply address, until answered. All supplies, both the currently addressed supply and all non-addressed supplies, will enable SRQ retransmission as a result of this command.

7.10.2.5 Enable FLT Bit in the SENA Register

The Hex value of the command is 0xA4. Send it two times in sequence.

7.10.3 Global commands with response

7.10.3.1 Disconnect from communications

Command the supply to end all data transmissions to the HOST PC/IEEE Board and cease its role as the active addressed supply. The HOST PC/IEEE Board will be required to re-send the 'ADR nn' command to reestablish communications with the supply. After receiving the first command the supply will respond with an OK<CR>. The Hex value of the command is 0xBF. All supplies, both the currently addressed supply and all non-addressed supplies, will respond to this command; but only the currently addressed supply (if any) will respond with the 'OK'.

7.10.4 Addressed commands with response

7.10.4.1 Read registers

Send (0x80 + Address) (1 byte binary - send 2 times sequentially). The supply will return the contents of the Status Condition Register, the Status Enable Register, the Status Event Register (SEVE?), the Fault Condition Register, the Fault Enable Register and the Fault Event Register IFEVE/). All registers will be represented in two Hex bytes. Following the register data, a single dollar sign, $, will be added to signal the end of data and the start of a checksum. The checksum will be the sum of all register data and will be represented in two Hex bytes. The transmission will end with the CR character. If repetitive sending of SRQs was active and the supply was sending them, the supply will stop sending repetitive SRQs but leave the function active. The contents of the registers will not be destroyed. Note that the supply does snot have to be the active addressed supply.
Note that this command will not execute if another command is being processed.

7.10.4.2 Print Power On Time

Print the total time the supply has operated under AC power. Send 2 bytes in sequence, A6 Hex and the address of the supply in binary. A 32 bit integer will be returned in 8 Hex bytes. The data will be the number of minutes that power has been 'ON' in the supply in binary. A '$' sign and 2 byte Hex checksum will be appended to the data. There is no method provided to reset this number.
Retransmit last message.
Send (0xC0 + Address) (1 byte binary - send 2 times sequentially). The supply will return the last message sent. Note that the supply does not have to be the active addressed supply.
This command will not execute if another command is being processed.
Note that Single byte commands do not load data into the supply's data output buffer.
Thus this command will not cause the supply to retransmit data obtained from any previous Single Byte Command.

7.10.4.3 Retransmit Last Message

Send (0xC0 + Address) (1 byte binary - send 2 times sequentially). The supply will return the last message sent. Note that the supply does not have to be the active addressed supply.
This command will not execute if another command is being processed.
Note that Single byte commands do not load data into the supply's data output buffer. Thus this command will not cause the supply to retransmit data obtained from any previous Single Byte Command.

7.10.4.4 Test if MD Mode is Installed

Send AA Hex followed by the address of the supply in binary. If not installed, the supply will return a '1'. If installed, the supply will return a '0'.

7.10.5 Addressed commands without response

7.10.5.1 Acknowledge SRQ

Send (0xE0 + Address) (1 byte binary - send 2 times sequentially). The supply will stop resending SRQ. If Enable SRQ retransmission is active, it will remain active.

7.10.5.2 Re-enable SRQ with out reading/clearing the SEVE Register

Send A5 Hex followed by the address of the supply in binary and new SRQ's generated by new events in the Fault Event will be enabled without reading and clearing the Status Event Register. All events previously recorded in the Fault Event Register must have been serviced by the user's software prior to this command to take effect.

Name	Bit Positions	Response	Description
Global Commands			
Disable MD Mode	1010 0000	None	Set supplies out of MD Mode (default)
Enable MD Mode	1010 0001	None	Set supplies into MD Mode
Disable SRQ retransmission	1010 0010	None	Disable retransmission of SRQs by supplies (default)
Enable SRQ retransmission	1010 0011	None	Enable retransmission of SRQs by supplies
Enable FLT Bit	1010 0100	None	Enable the FLT bit in the SENA Register
Disconnect serial communications	1011 1111	OK	All supplies will halt transmission and enter the non-addressed state.
Addressed Commands			
Read Registers	100x xxxx	Register data	Non destructive read of all register. x xxxx is the address of the supply in binary.
Re-enable SRQ	Byte 1 1010 0101 Byte 2 xxxx xxxx	None	Re-enable SRQ without reading or clearing the SEVE Register. xxxx xxxx is the address of the supply in binary. Works only in MD Mode.

Print Power On Time	Byte 1 1010 0110 Byte 2 xxxx xxxx	Power On time in min-utes	Read the time the supply is active under AC Power. xxxx xxxx is the address of the supply in binary. Returns a 32 Bit integer as 8 Hex bytes. A '$' sign is appended to the data followed by a 2 byte check-sum. A total of 11 bytes are returned.
Retransmit last message	110x xxxx	Last message	Retransmit last response from a command. x xxxx is the address of the supply in binary.
Acknowledge SRQ	111x xxxx	None	Acknowledge SRQ. If retransmis-sion of SRQ is enabled, it will re-main enabled for the next SRQ. X xxxx is the address of the supply in binary.
Test if MD Mode is Installed	Byte 1 1010 1010 Byte 2 xxxx xxxx	0 or 1	Returns a 0 if not installed or a 1 if installed. A '$' sign followed by a 2 bytes checksum and Carriage Re-turn is appended to the data. xxxx xxxx is the address of the supply in binary.
Supply Initiated Communications			
SRQ	100x xxxx	N/A	SRQ from supply when in MD Mode. X xxxx is the address of the supply in binary.

Table 7-4. SINGLE BYTE COMMUNICATIONS

GEN750W models

Table 7-5: Current programming range

Model	Minimum (A)	Maximum (A)
GEN6-100	000.00	100.00
GEN8-90	00.00	90.00
GEN12.5-60	00.000	60.000
GEN20-38	00.000	38.000
GEN30-25	00.000	25.000
GEN40-19	00.000	19.000
GEN60-12.5	00.000	12.500
GEN80-9.5	0.000	9.500
GEN100-7.5	0.000	7.500
GEN150-5	0.000	5.000
GEN300-2.5	0.000	2.500
GEN600-1.3	0.000	1.300

NOTE:
The power supply can accept values 5% higher than the table values, however it is not recommended to program the power supply over the rated values.

Table 7-6: OVP programming range

Model Rated Output Voltage (V)	Minimum (V)	Maximum (V)
6	0.5	7.50
8	0.5	10.0
12.5	1.0	15.0
20	1.0	24.0
30	2.0	36.0
40	2.0	44.0
60	5.0	66.0
80	5.0	88.0
100	5.0	110.0
150	5.0	165.0
300	5.0	330.0
600	5.0	660.0

Table 7-7: UVL programming range

Model Rated Output Voltage (V)	Minimum (V)	Maximum (V)
6	0	5.70
8	0	7.60
12.5	0	11.9
20	0	19.0
30	0	28.5
40	0	38.0
60	0	57.0
80	0	76.0
100	0	95.0
150	0	142
300	0	285
600	0	570

7.10.6 Status Control Commands

Refer to Section 7-8 for definition of the registers.

#	Command	Description
1	STT?	Reads the complete power supply status. Returns ASCII characters representing the following data, separated by commas: MV<actual (measured) voltage> PC<programmed (set) current> PV<programmed (set) voltage> SR<status register, 2-digit hex> MC<actual (measured) current> FR<fault register, 2-digit hex> Example response: MV(45.201),PV(45), MC(4.3257), PC(10), SR(30), FR(00)
2	FLT?	Reads Fault Conditional Register. Returns 2-digit hex.
3	FENA	Set Fault Enable Register using 2-digit hex.
4	FENA?	Reads Fault Enable Register. Returns 2-digit hex.
5	FEVE?	Reads Fault Event Register. Returns 2-digit hex. Clears bits of Fault Event Register.
6	STAT?	Reads Status Conditional Register. Returns 2-digit hex.
7	SENA	Sets Status Enable Register using 2-digit hex.
8	SENA?	Reads Status Enable Register. Returns 2-digit hex.
9	SEVE?	Reads Status Event register. Returns 2-digit hex. Clears bits of Status Event register.

7.11 STATUS, ERROR AND SRQ REGISTERS

7.11.1 General Description

This Section describes the various status error and SRQ registers structure. The registers can be read or set via the RS232/RS485 commands. When using the IEEE option, refer to the User's Manual for Genesys™ Power Supply IEEE Programming Interface.

Refer to Fig. 7-7 for the Status and Error Registers Diagram.

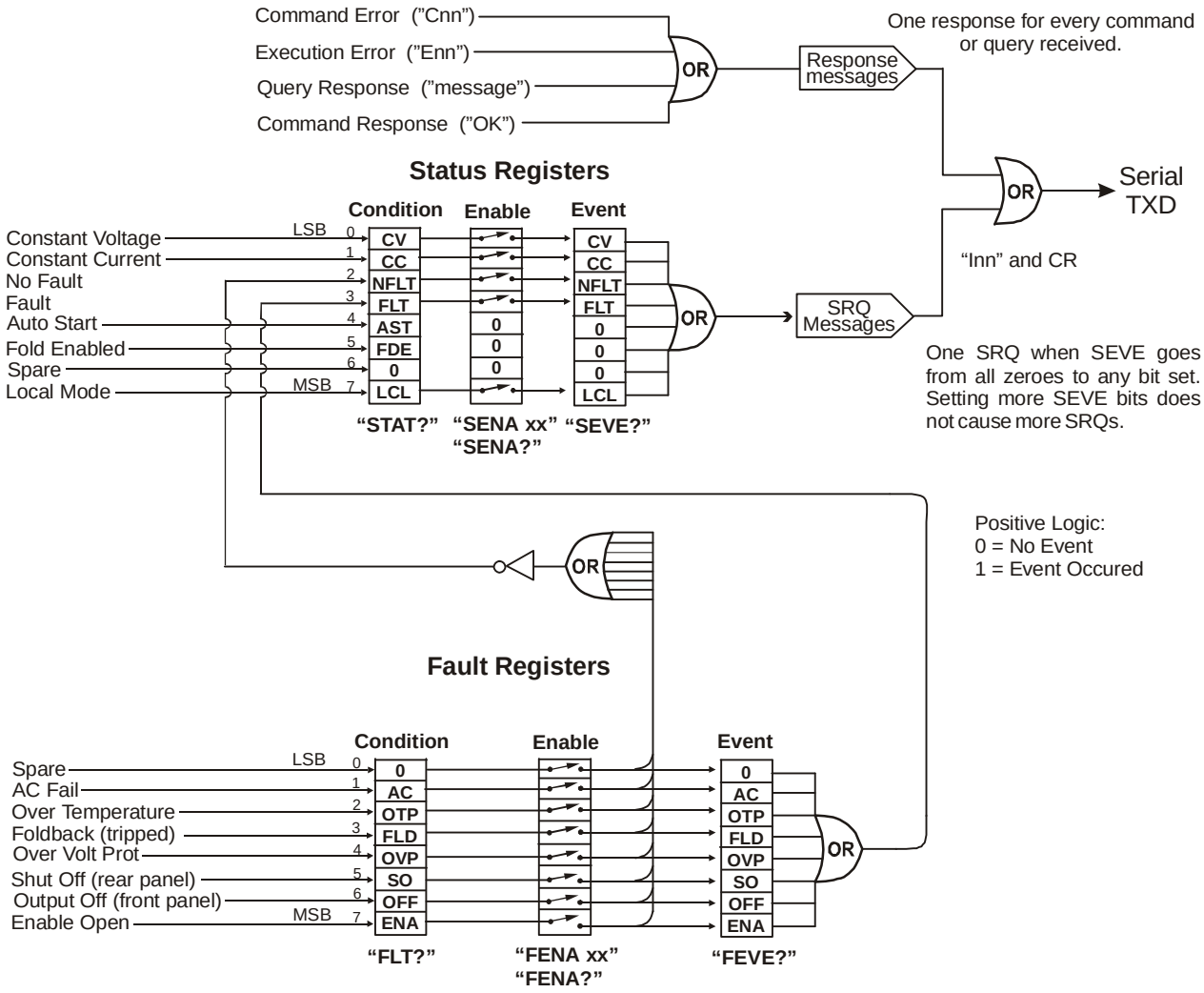


Fig.7-7: Status and Error Registers Diagram

7.11.2 Conditional Registers

The fault Condition Register and the Status Condition Register are read only registers that the user may read to see the condition of the Power supply. Refer to Table 7-8 for description of the Fault Condition Register bits and Table 7-9 for the Status Condition register bits.

7.11.2 Conditional Registers (continued)

Table 7-8: Fault Condition Register

BIT	Fault name	Fault symbol	Bit Set condition	Bit Reset condition
0 (LSB)	Spare bit	SPARE	Fixed to zero	Fixed to zero
1	AC Fail	AC	AC fail has occurred.	The AC input returns to normal.
2	Over temperature	OTP	OTP shutdown has occurred.	The power supply cools down.
3	Foldback	FOLD	Foldback shutdown has occurred	The supply output is turned On by front panel button or OUT 1 command.
4	Over voltage	OVP	OVP shutdown has occurred.	The supply output is turned ON by front panel button or OUT 1 command.
5	Shut Off	SO	Rear panel J1 “Shut Off” condition has occurred.	Rear panel J1 “Shut Off” condition has been removed.
6	Output Off	OFF	Front panel OUT button pressed to Off.	The supply output is turned On by front panel button or OUT 1 command.
7(MSB)	Enable	ENA	Rear panel J1 Enable terminal (J1-1&J1-14) opened.	Rear panel J1 Enable terminals closed.

Table 7-9: Status Condition Register

BIT	Fault name	Fault symbol	Bit Set condition	Bit Reset condition
0 (LSB)	Constant Voltage	CV	Output is On and the supply in CV.	Output is ON and the supply is not in CV.
1	Constant Current	CC	Output is ON and the supply in CC.	Output is ON and the supply is not in CC.
2	No Fault	NFLT	The power supply is operating normally or fault reporting is not enabled. See “OUT n” command in Section 7.7.5.	One or more faults are active and fault reporting is enabled (using “FENAxx”).
3	Fault active	FLT	One or more faults are enabled and occur.	Fault Event Register cleared (FEVE?).
4	Auto-Restart Enabled	AST	Supply is in Auto-Restart mode (from Front Panel or serial command).	Supply is in Safe-Start mode (from Front Panel or serial command).
5	Fold Enabled	FDE	Fold protection is enabled (from Front Panel or serial command).	Fold protection disabled (from Front Panel or serial command).
6	Spare bit	SPARE	Fixed to zero.	Fixed to zero.
7(MSB)	Local Mode	LCL	Supply in Local mode.	Supply in Remote mode or Local-Lockout mode.

7.11.3 Service Request: Enable and Event Registers

The conditional Registers are continuously monitored. When a change is detected in a register bit which is enabled, the power supply will generate an SRQ message.

The SRQ message is: “Inn” terminated by CR, where the nn is the power supply address. The SRQ will be generated either in Local or Remote mode.

Refer to Tables 7-10 to 7-13 for details of the Enable and Event registers.

1. Fault Enable Register

The Fault Enable Register is set to the enable faults SRQs.

Table 7-10: Fault Enable Register

BIT	Enable bit name	Fault symbol	Bit Set condition	Bit reset condition
0 (LSB)	Spare bit	SPARE	User command: “FENA nn” where nn is hexadecimal	User command: “FENA nn” where nn is hexadecimal (if nn=”00”, no fault SRQs will be generated).
1	AC Fail	AC		
2	Over Temperature	OTP		
3	Foldback	FOLD		
4	Over Voltage	OVP		
5	Shut Off	SO		
6	Output Off	OFF		
7(MSB)	Enable	ENA		

2. Fault Event Register

The Fault Event will set a bit if a condition occurs and it is Enabled. The register is cleared when FEVE?, CLS or RST commands are received.

Table 7-11: Fault Event Register

BIT	Enable bit name	Fault symbol	Bit Set condition	Bit reset condition
0 (LSB)	Spare bit	SPARE	Fault condition occurs and it is enabled. The fault can set a bit, but when the fault clears the bit remains set.	Entire Event Register is cleared when user sends “FEVE?” command to read the register. “CLS” and power-up also clear the Fault Event Register. (The Fault Event Register is not cleared by RST)
1	AC Fail	AC		
2	Over Temperature	OTP		
3	Foldback	FOLD		
4	Over Voltage	OVP		
5	Shut Off	SO		
6	Output Off	OFF		
7(MSB)	Enable	ENA		

3. Status Enable Register

The Status Enable Register is set by the user to Enable SRQs for changes in power supply status.

Table 7-12: Status Enable Register

BIT	Status name	Status symbol	Bit Set condition	Bit reset condition
0 (LSB)	Constant Voltage	CV	User command: "SENA nn" is received, where nn is hexadecimal bits.	User command: "SENA nn" is received, where nn is hexadecimal bits. If "nn"=00, no SRQ is sent when there is a change in Status Condition Register.
1	Constant Current	CC		
2	No Fault	NFLT		
3	Fault active	FLT		
4	Auto-Restart enabled	AST	Always zero	Always zero
5	Fold enabled	FDE	Always zero	Always zero
6	Spare	Spare	Always zero	Always zero
7 (MSB)	Local Mode	LCL	"SENA nn" command	"SENA nn" command

4. Status Event Register

The Status Event Register will set a bit if a change in the power supply status occurs and it is enabled. The register is cleared when the "SEVE?" or "CLS" commands are received. A change in this register will generate SRQ.

Table 7-13: Status Event Register

BIT	Status name	Status symbol	Bit Set condition	Bit reset condition
0 (LSB)	Constant Voltage	CV	Changes in status occur and it is Enabled. The change can set a bit, but when the change clears the bit remains set.	Entire Event Register is cleared when user sends "SEVE?" command to read the register. "CLS" and power-up also clear the Status Event Register.
1	Constant Current	CC		
2	No Fault	NFLT		
3	Fault active	FLT		
4	Auto-Restart enabled	0	Always zero	
5	Fold enabled	0	Always zero	
6	Spare	0	Always zero	
7 (MSB)	Local Mode	LCL	Unit is set to Local by pressing front panel REM/LOC button.	

7.12 SERIAL COMMUNICATION TEST SET-UP

Use the following instructions as basic set-up to test the serial communication operation.

1.Equipment: PC with Windows Hyper Terminal, software installed, Genesys™
Power supply, RS232 cable.

2. PC set-up: 2.1 Open Hyper Terminal……New Connection.
2.2 Enter a name
2.3 Connect to……Direct to Com 1 or Com 2
2.4 Configure port properties:
Bits per second……9600
Data bits……8
Parity……None
Stop bits……1
Flow control……None
2.5 Open Properties in the program File……Properties
2.6 Setting: ASCII Set Up
Select Echo characters locally, select send line ends with line feed. On some PC systems, pressing the number keypad "Enter" will distort displayed messages. Use the alphabetic "Enter" instead.

3. Power supply set-up:

3.1 Connect the power supply to the PC using the RS232 cable.
3.2 Set via the front panel: Baud Rate: 9600, Address: 06 (default).
3.3 Set via the rear panel: RS232/RS485 to RS232 (refer to Section 4-4).

4. Communication Test:

4.1 Model identification:
PC:write: ADR 06
Power supply response: "OK"

4.2 Command test:
PC write: OUT1
Power supply response: "OK"
PC write: PVn
Power supply response: "OK"
PC write: PCn (for values of n see Tables 7-4, 7-5 and 7-6)
Power supply response: "OK"

The power supply should turn on and the display will indicate the actual Output Voltage and the actual Output Current.