GENESYS™ Series

Programmable DC Power Supplies

GH1kW in 1U Half-Rack 0–600V / 0–100A

GH1.5kW in 1U Half-Rack 0–600V / 0–150A

G1kW in 1U 0–600V / 0–100A

G1.7kW in 1U 0–600V / 0–170A

G2.7kW in 1U 0–600V / 0–265A

G3.4kW in 1U 0–600V / 0–340A

G5kW in 1U 0–1500V / 0–500A

G7.5kW in 1U 0–1500V / 0–375A

GSP10kW in 2U 0–600V / 0–1000A

GSP15kW in 3U 0–600V / 0–1500A

GSPL15kW in 2U 0–1500V / 0–750A

GSPL22.5kW in 3U 0–1500V / 0–1125A

GSPS30kW, 45kW, 60kW in 20U 0–600V / 0–4500A

Built in LXI compliant LAN, USB, RS-232 & RS-485 Interface

Optional Interface: IS420, IEEE488.2 (GPIB), MODBUS TCP or EtherCAT

MODBUS TCP MANUAL

Manual Supplements

The full user manual is available on TDK-Lambda website or can be ordered, refer to User manual IA761-04-02_.

IA761-04-04D

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TABLE OF CONTENTS

GENERAL INFORMATION

Documentation (including this Manual) is subject to change without notice. Refer to TDK-Lambda Technical Data web page for an up-to-date documentation:

https://www.emea.lambda.tdk.com/uk/technical-data/data.aspx?resource=Installation-Manuals

Drivers and GUIs are updated periodically to support new features. Refer to TDK-Lambda Technical Centre web page for up-to-date drivers and GUIs:

https://www.emea.lambda.tdk.com/uk/technical-centre/software-tools.aspx

CHAPTER 1: INTRODUCTION

1.1 Introduction

The MODBUS TCP (a short form of MODBUS TCP/IP) option for the ***GENESYS***™ power supply series allows the user to remotely program, measure, and check status of the power supply by MODBUS TCP protocol implementation over the internet. MODBUS TCP is listening on a reserved system port 502 on the TCP/IP protocol. Refer to ***GENESYS***™ SAFETY & INSTALLATION manual (IA761-04-01_) for information on safety requirements, specifications, and installation. Refer to ***GENESYS***™ USER MANUAL (IA761-04-02_) for information on power supply operation.

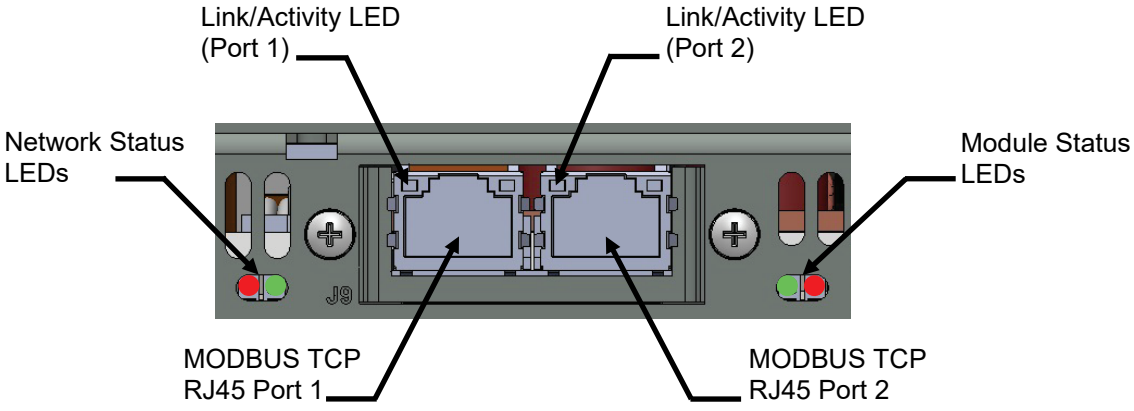


Figure 1–1: Rear Panel MODBUS TCP View

1.2 Feature Summary

A. Communicate over any standard TCP/IP network

- LAN (Local Area Network).
- WAN (Wide Area Network).
- Communicate across the world using the Internet.
- PING server is supported.
- Timeout – TCP socket is closed after 1 minute if no commands are sent.

B. Web page viewable with any web page browser

- Configure network connection settings.
- Interface / Media counters monitoring.

C. Full remote programming and monitoring functions

- Uses MODBUS TCP command language.
- Compatible with MODBUS TCP test & measurement utilities.
- TCP sockets which support PLCs, Linux, and other non-VISA controllers.
- Multiple and simultaneous (up to 4) sockets connections are allowed by port 502.

D. Front Panel features

- View IP and MAC addresses.
- Set a complete IP address.
- MODBUS TCP (OPT) reset.
- Remote “Blink” identity function to locate the power supply in a rack.

E. Rear Panel features (2-Port MODBUS TCP)

- Two Ethernet RJ-45 connectors (standard 8 pin jack).
- Allow connection of multiple MODBUS TCP power supplies directly.
- Each power supply receives its own IP address.
- Network status, module status, and two ports link/activity indicators.

F. RS-485 Multi-drop Chain

- Allow connection of up to 31 power supplies using a simple link cable.
- One MODBUS TCP IP address shared by all RS-485 power supplies.

NOTE

Only one of the two Ethernet RJ-45 connectors should be connected to a master PC/PLC.

CHAPTER 2: SPECIFICATIONS

2.1 Power Supply Specifications

When using MODBUS TCP, power supply ratings and accuracies are the same as for digital remote programming and monitoring using RS-232/485, USB, or LAN. Refer to USER MANUAL (IA761-04-02_) for those specifications.

2.2 MODBUS TCP Specifications

ELECTRICAL

ETHERNET	Meets IEEE 802.3u specifications
Auto-MDIX	Accepts patch or cross-over cable connection
Auto-Negotiate	Selects fastest of 10Base-T or 100Base-T networks (10 or 100 Megabits per second (Half or Full Duplex)

NETWORK CONFIGURATION

MAC Address	MODBUS TCP has a unique MAC address (different from the built-in LAN).
IP Address	View or set from front panel or embedded web page
DHCP	Receive address from network server. Lease service.
Static IP	Any IP fixed by operator
Address Resolution	ARP Protocol
Hostname	DNS protocol. Operator settable hostname.
Subnet Mask	Mask set by DHCP or Static
Default Gateway	Address set by DHCP or Static
DNS Server	Address set by DHCP
PING Server	Verify MODBUS TCP connection to instrument
MODBUS TCP Reset	Reset to default configuration

MODBUS TCP PROTOCOLS

TCP	MODBUS TCP packets follow Transmission Control Protocol
IPv4	Internet Protocol version 4

COMMANDS

MODBUS TCP	MODBUS TCP packets follow Transmission Control Protocol

MULTIPLE CONTROLLERS

Multiple Client	Up to 4 concurrent web pages or 4 TCP socket channels

WEB PAGE

Multiple Users	Multiple web pages (up to 4) can be opened at the same time
LAN Configuration	View and set LAN configuration

SUPPLY CONFIGURATIONS

Local Control	Supply may be controlled from the front panel even if operator is monitoring via MODBUS TCP connection
MODBUS TCP Remote Control	Supply may be controlled and monitored through MODBUS TCP connection
RS232/485, USB, or LAN	MODBUS TCP interface can be disabled to use RS232/485, USB, or LAN interfaces
Analog Control	MODBUS TCP can monitor power supply while analog control is used

INDICATORS

IP & MAC Addresses	View addresses on front panel
Multi-Drop Address	View RS485 address on front panel
Link & Activity LEDs	Indicate Ethernet cable connected at both ends, defines connection speed and LAN packets detected (LED per MODBUS TCP port)
Network Status LED	Indicate no IP address or IP exception, an error, connection timeout, waiting for first MODBUS TCP message, or at least one MODBUS TCP message received
Module Status LED	Indicates no power, normal operation, fault, or firmware update

SECURITY

Block All Protocols	All protocols except MODBUS TCP are blocked
TCP Sockets	Only TCP sockets (up to 4) can be opened
Single Port	Only port 502 is listening

COMPLIANCE

UL, IEC, TUV, CE, ROHS, etc.	Conformances that are granted to basic power supply also apply to power supply with MODBUS TCP interface installed

2.3 MODBUS TCP Command Speed

The following communication speeds are typical values only. In addition to the variability in the GENESYS™ MODBUS TCP interface, there are timing variations within the controller and the network routing.

Test is done using a single TCP socket application with the power supply set to a static IP address, peer-peer configuration.

NOTE

The following speed specifications are subject to change without notice.

Typical command or query speeds (including commands not listed below):

		90% of Commands in less than:	100% of Commands in less than:
Basic Settings and Measurements			
Examples:		8 mSec	12 mSec
VOLT nn.nn	VOLT?		
MEAS:VOLT?			
MEAS:CURR?			
MEAS:POW?			
OUTP	OUTP?		
OUTP:MODE?			
VOLT:PROT:LEV	VOLT:PROT:LEV?		
System Queries			
Examples:		60 mSec	74 mSec
SYST:ERR?			
*ESR?			
*OPT?			
SYST:PON:TIME?			
SYST:TEMP?			
Status Register Settings and Queries			
Examples:		8 mSec	12 mSec
STAT:QUES:COND	STAT:QUES:COND?		
STAT:QUES:ENAB	STAT:QUES:ENAB?		

		90% of Commands in less than:	100% of Commands in less than:
Instrument Select for Multi-Drop			
Example:		6 mSec	14 mSec
INST:NSEL	INST:NSEL?		
Identity Query			
Example:		46 mSec	56 mSec
*IDN?			
Operation Complete			
Example:		6 mSec	12 mSec
*OPC	*OPC?		

NOTES

1. Data is shown as SCPI commands. Actual tests are performed on MODBUS TCP registers.
2. Commands which are longer than a single register might require additional execution time.
3. Sequencer commands depend on the number of registers being read/written.

CHAPTER 3: SELECT CONTROL METHOD

3.1 A Variety of Control Methods

The ***GENESYS™*** power supply with MODBUS TCP interface is very flexible. In addition to the MODBUS TCP interface, there are other ways the supply can be used.

Refer to USER MANUAL (IA761-04-02_) for more details on the local operation mode (Front Panel), Serial operation mode (RS232/485 or USB), LAN operation mode (Ethernet), or Analog (Via J1, DB26HD).

3.2 MODBUS TCP, LAN, LOCAL, Serial, or Analog Control

The ***GENESYS™*** power supply, with MODBUS TCP interface option installed, may be operated through five interfaces. This section describes how to enable each.

	MODE	MODE DESCRIPTION	
1	MODBUS TCP	Control using Ethernet connection by MODBUS TCP registers	MODBUS TCP disables serial and LAN communication ports
2	LAN	Control using Ethernet connection by SCPI commands	MODBUS TCP is disabled if LAN is selected
3	Local	Control using the front panel buttons and encoders	MODBUS TCP can be used to monitor while in local mode
4	Serial	Control using RS232/485 or USB	MODBUS TCP is disabled if Serial is selected
5	Analog	Control using analog signals to the 26 pin ‘J1’ DB26HD connector	MODBUS TCP, LAN, Local, or Serial can be used to monitor and set protections

3.2.1 Select Local (Front Panel) Mode

The supply may be operated in the local (or front panel) mode, even when a computer is using the MODBUS TCP connection.

If the supply is in remote mode, the front panel REM indicator is ON. The supply may be returned to local by pressing SYST / Lock Front Panel button and acknowledged by clicking the Current encoder button.

If the power supply does not switch into local mode, then:

- If a MODBUS TCP program is running to change power supply settings/parameters, it will automatically go to remote with every command. Stop MODBUS TCP program and then return the supply to local mode by pressing SYST / Lock Front Panel button and acknowledge by clicking the Current encoder button.
- The supply may be set to Local Lockout. Use MODBUS TCP Register 1006 to read or write power supply remote state, or turn the supply AC off and back on, and then press SYST / Lock Front Panel button and acknowledge by clicking the Current encoder button.

3.2.2 Select RS232/485, USB (Serial), or LAN Remote Mode

The serial (RS232/485 & USB) and LAN remote control may be selected even if MODBUS TCP option is installed. The serial and LAN remote modes are described in the ***GENESYS™*** USER MANUAL (IA761-04-02_). The MODBUS TCP has similar capabilities as the serial and LAN remote modes, but the MODBUS TCP programming language is not compatible with the serial or LAN languages (GEN or SCPI).

To select RS232/485, USB, or LAN mode:

1. Press the COMM button.

   COMM LED illuminates. INTFC message appears on the Voltage display.

2. Rotate the Current encoder to select the required communication interface.
3. Press the Current encoder to accept parameter.

   When the parameter is accepted, the display blinks once.

4. To exit the menu, press the COMM button or the BACK button.

3.2.3 Select MODBUS TCP Remote Mode

Selecting the MODBUS TCP mode allows programming over the Ethernet cable. Any setting and measurement may be done from a remote computer using the MODBUS TCP communication. Network configuration settings can be done via built-in web pages.

To select MODBUS TCP mode:

1. Press the COMM button.

   COMM LED illuminates. INTFC message appears on the Voltage display.

2. Rotate the Current encoder to select the OPT communication interface.
3. Press the Current encoder to accept parameter.

   When the parameter is accepted, the display blinks once.

4. To exit the menu, press the COMM button or the BACK button.

NOTE

Refer to ***GENESYS™*** USER MANUAL (IA761-04-02_), SYSTem[:COMMunicate]:INTerface <DSC> command to select MODBUS TCP (OPT) communication interface via communication (via RS232/485, USB, or LAN).

3.3 MODBUS TCP Interface Option Rear Panel View

The power supply rear panel, with the MODBUS TCP option installed, is shown below:

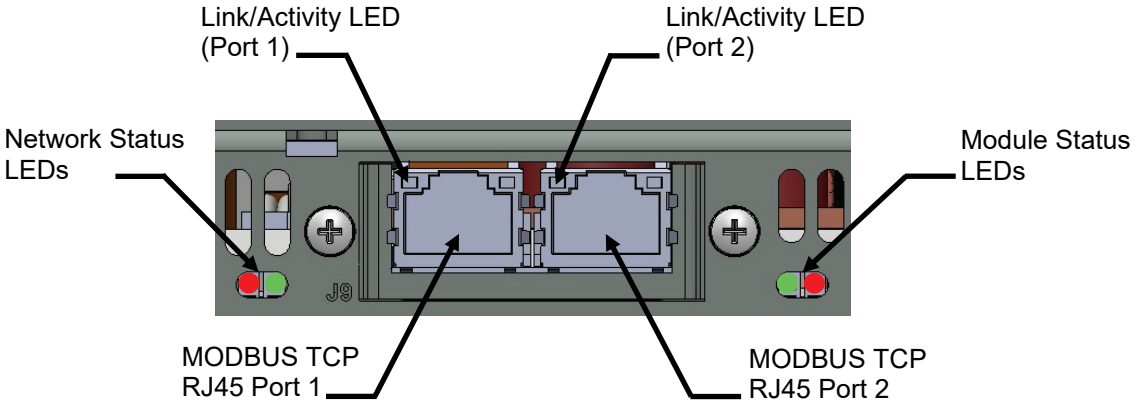


Figure 3–1: Rear Panel MODBUS TCP View

Network Status LEDs	Off – No IP address or in an EXCEPTION state Green – At least one MODBUS TCP message received Green, flashing – Waiting for first MODBUS TCP message Red – Duplicate IP
Module Status LEDs	Off – No power Green – Normal operation Red – Major fault (including Anybus exception) Red, flashing – Minor fault Alternating Red / Green – Firmware update from file system in progress
Link / Activity LED	Off – No link, no activity Green – Link (100 Mbps) established Green, flickering – Activity (100Mbps) Yellow – Link (10 Mbps) established Yellow, flickering – Activity (10 Mbps)

NOTE

MODBUS TCP interface supply is ready for communication as soon as Network Status LEDs turn Green or flashing Green. If communication is established before the interface is ready, communication interruptions may occur.

CHAPTER 4: CONNECT TO NETWORK

4.1 Ethernet Cable

The Ethernet cable must be supplied by the customer. It may be a standard straight “patch” CAT-5 (or better) network cable or a “crossover” cable. Cable type is auto-detected by the power supply.

NOTE

The serial link (RS-485) cable (0.5 meters long) provided with the ***GENESYS™*** power supply cannot be used for MODBUS TCP connection.

4.2 Types of Networks

There are two types of networks discussed in this document:

4.2.1 NETWORK WITH A DHCP SERVER

A typical local area network with a server computer and network administrator to keep it operating. The server downloads the IP address and other settings to the power supply.

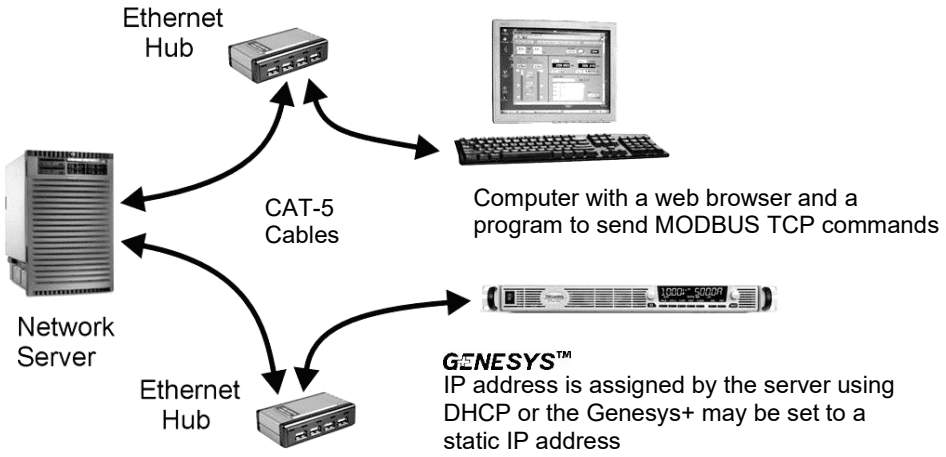


Figure 4–1: Network with a DHCP Server

4.2.2 PEER-TO-PEER NETWORK

In this type of configuration, the power supply is connected directly to a computer that is not a network server. The power supply configures its own IP address and other settings.

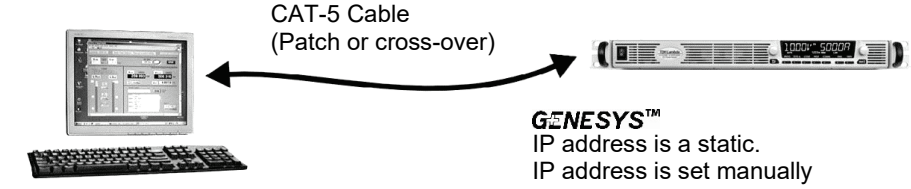


Figure 4–2: Peer-to-Peer Network

4.3 Power-up the MODBUS TCP Power Supply

The power supply MODBUS TCP option automatically detects if it is connected or disconnected from a network. It automatically searches for a network server and receives or creates an IP address (set manually). It will also broadcast its IP address and hostname to all other devices on the network.

1. Apply the AC power and switch ON the power supply.
2. Connect the Ethernet cable before or after the power supply is switched ON.
3. For a network with a DHCP server, wait about 10 seconds. Module Status LED turns Green.
4. For a peer-to-peer Static IP configuration, set Static IP and wait about 10 seconds. Module Status LED turns ON. The computer screen may show LAN notification, "This connection has limited or no connectivity".

NOTE

Power supply IP address can be viewed via the Front Panel.

4.4 IP Addresses

The simplest and most reliable way to open a network connection is via the power supply's IP address, which is represented by a group of four numbers separated by periods (e.g., 10.1.15.123).

The power supply can receive an IP address in two modes:

	DHCP	Static IP
IP Mode Select	DHCP is default after "MODBUS TCP Reset"	May be set in the web page (6.6) or by setting via the front panel (5.2)
IP Assignment	Assigned by the network server	Assigned in the web page (6.6) or by setting via the front panel (5.2)
IP Range	Any address	Any address
IP Lifetime	Address may change as the DHCP server assigns addresses dynamically to many instruments	Always fixed for the power supply
Duplicate IP Addresses	The DHCP server should prevent duplicate IP addresses	Network Status LED turns Red. IP address is set to 0.0.0.0

NOTE

Auto-IP method is not supported.

4.5 Hostname

The hostname is an address in the form of name instead of IP address (e.g., G10-170). This address mode is less common than the IP address because the hostname cannot be viewed from the front panel, and because a naming service (such as NetBIOS or DNS) must be running on the network or the host PC.

The default hostname has the following format:

< Product Series Name> < Voltage rating > – < Current rating >.

If default power supply rating has decimal point, it is represented as “P”.

For example:

Model	Default Hostname
G10-500	G10-500
G600-2.8	G600-2P8

A custom host name can be created through the web pages (refer to Section 6.6).

For example, host name can be set to `TDK`. In this case, the control program can send commands to `TDK`.

MODBUS TCP (OPT) Reset changes the host name to default.

The power supply may be set to one of the two network modes, each with a different way to use the host name. This is shown in the table:

	DHCP	Static IP
Default Hostname	xxxxvvvv-aaaa (Refer to hostname example above)	None, hostname cannot be used
Hostname Protocol	Hostname by DNS	None, hostname cannot be used
Hostname on Web Page	Shows hostname in the Network Configuration page	None, hostname cannot be used

NOTE

There is no mechanism to detect duplicate hostname. Avoid setting of hostname which is already available in the network.

CHAPTER 5: MODBUS TCP SETUP

5.1 View the IP and MAC Addresses

When the power supply is operating with the MODBUS TCP enabled, IP and MAC addresses may be viewed on the front panel. To view the IP and MAC addresses, perform the following steps:

To view the IP address:

1. Press COMM button.
2. Rotate Voltage encoder until IP appears on the Voltage display, 1 appears on the Current display.
3. Press Current encoder to enter IP configuration. Rotate Voltage encoder to view the IP address.

   The voltage display shows IP1-IP4 by rotating Voltage encoder. The current display shows the corresponding IP field.
4. To exit the menu, press the COMM button or the BACK button.

To view the MAC address:

1. Press COMM button.
2. Rotate Voltage encoder until MAC appears on the Voltage display, 1 appears on the Current display.
3. Press Current encoder to enter MAC configuration. Rotate Voltage encoder to view the MAC address.

   The voltage display shows MAC1-MAC6 by rotating Voltage encoder. The current display shows the corresponding MAC field.
4. To exit the menu, press the COMM button or the BACK button.

5.2 Change the IP Address

The power supply allows changing all four numbers (octets) of the IP address via the front panel.

The IP address has four numbers (e.g., 10.97.4.4). Each number may be set to any value from 0 to 255.

NOTE

Some restrictions may apply due to subnet settings restrictions.

To change the IP address:

1. Press COMM button. Rotate Voltage encoder until IP appears on the Voltage display, 1 appears on the Current display.
2. Press Current encoder to enter IP configuration. Rotate Voltage encoder to view the IP address. Voltage display shows IP1-IP4 by rotating Voltage encoder. The Current display shows the corresponding IP address.
3. Rotate Current encoder to change the IP address. Set IP1, IP2, IP3, and IP4 fields. Press Current encoder to acknowledge new IP address (Current encoder should be pressed after all four IP fields are set).
4. If another device is using the same address, Network Status LED turns Red.
5. To exit the menu, press the COMM button or the BACK button.

NOTES

1. Modifying the IP address via the Front Panel switches to STATIC IP addressing. (DHCP addressing is disabled).
2. If power supply is turned on (AC or power switch) with a duplicate IP (same IP address is already available in the network), IP address setting is 0.0.0.0.

5.3 MODBUS TCP Reset

To reset MODBUS TCP settings to its factory settings, perform the following steps:

1. Press the COMM button.
2. Rotate Voltage encoder until OPT appears on the Voltage display, RESET appears on the Current display. Press Current encoder.
3. SURE appears on the Voltage display, NO appears on the Current display. Rotate current encoder one click clockwise. YES appears on the Current display.
4. Press Current encoder to reset MODBUS TCP configuration to factory default settings.

Default MODBUS TCP settings are:

- DHCP is enabled.
- If DHCP fails to get a lease, 0.0.0.0 IP setting will be obtained:

IP Address	0.0.0.0.
Subnet Mask	255.255.254.0
Gateway Address	0.0.0.0
Hostname	Refer to Section 4.5
Domain Name	Empty
DNS Server #1	0.0.0.0
DNS Server #2	0.0.0.0
Ethernet Configuration Port 1	Auto
Ethernet Configuration Port 2	Auto

CHAPTER 6: WEB PAGES

6.1 Benefits of Web Pages

The *GENESYS™* web pages are useful for:

- Reading Ethernet configuration, reading statistics, and verifying communication with the power supply.
- Configuring the LAN connection.

6.2 Opening the Overview Page

Once the rear Module Status LED turns Green and Network Status LED turns Green or Flashing Green (refer to Section 3.3 for LEDs overview), the web page is accessible.

1. Read the IP address from the front panel (refer to Section 5.1).
2. Open a web page browser program. Enter power supply's IP address as shown below.
3. Press the Enter key.

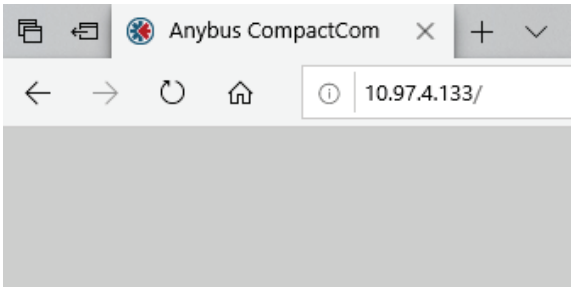


Figure 6–1: IP Main Page

The power supply Overview page appears.

Alternately, the hostname may be used for addressing the web page as shown below (if the power supply is set for DHCP, and if a DNS naming service is running on the computer). Refer to Section 4.5 for a description of the hostname. Refer to the example below.

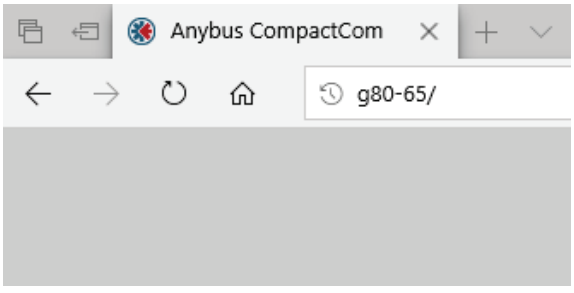


Figure 6–2: Hostname Main Page

6.3 MODULE Overview Page

The following page appears when the web page is opened for the first time or when it is refreshed:

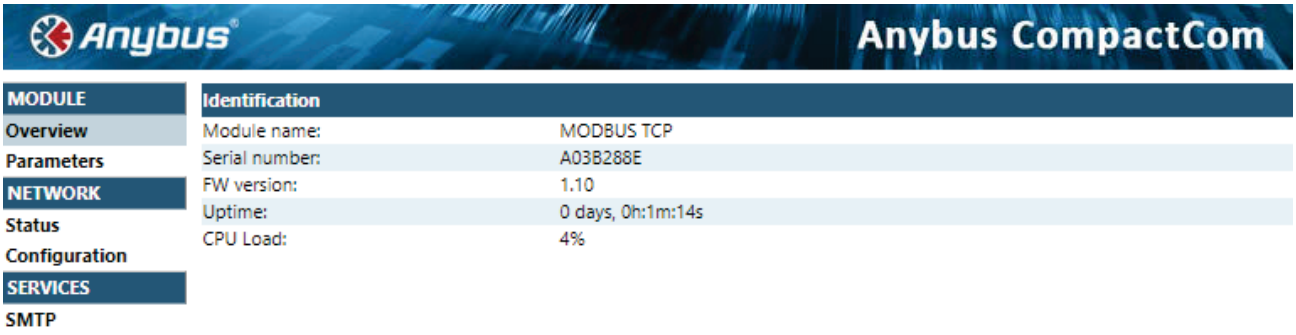


Figure 6–3: *GENESYS*™ Overview Page

Overview page contains basic information related to the optional module name (communication type), serial number, FW (firmware) revision, operation time since last communication enable (uptime), and internal (optional card only) CPU load.

6.4 MODULE Parameters Page

When the Parameters page is selected, the following web page opens. This page is not in use, it contains no data (page is kept as optional).

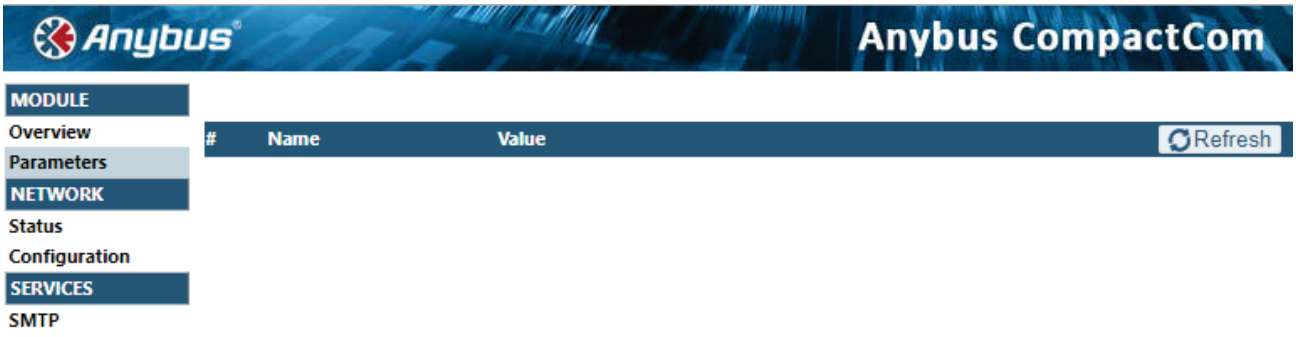


Figure 6–4: *GENESYS*™ Parameters Page

6.5 NETWORK Status Page

The Status contains four categories. General Ethernet Settings and Status view, Interface Counters, Media Counters, and MODBUS TCP Statistics.

6.5.1 General Ethernet Settings and Status View

General Ethernet Settings and Status view provides Ethernet configuration info. The info includes DHCP status, MAC address, IP address, hostname, subnet mask, gateway, DNS, domain name, and Ports (Port 1 and port 2) link status.

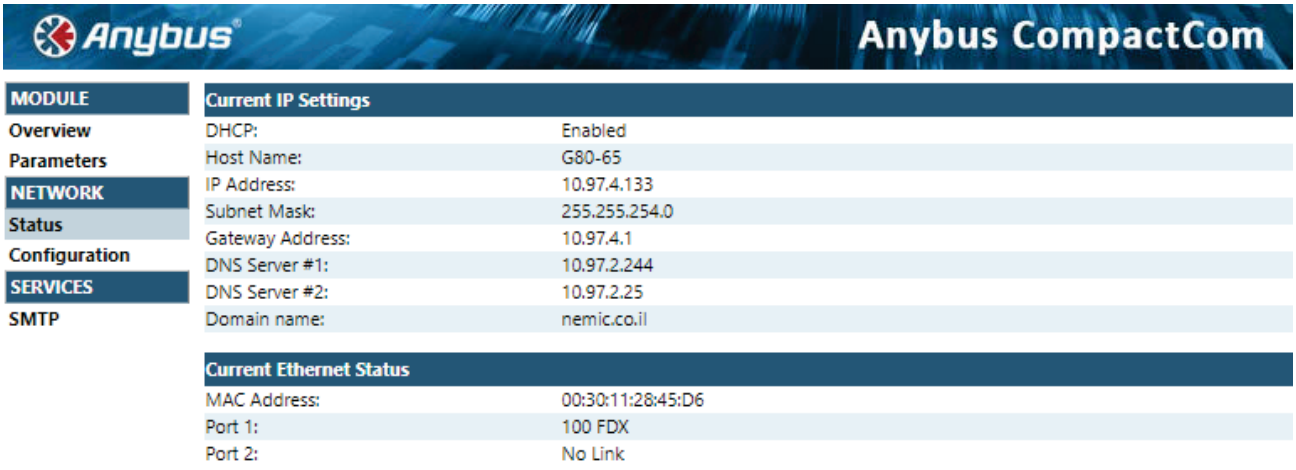
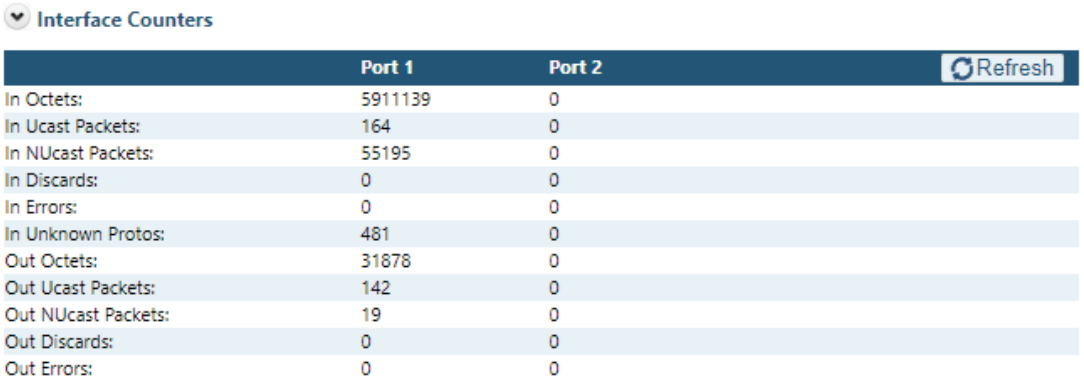


Figure 6–5: *GENESYS*™ Ethernet Settings and Status View

6.5.2 Interface Counters View

Interface Counters view provides general information related to internal input output counters.

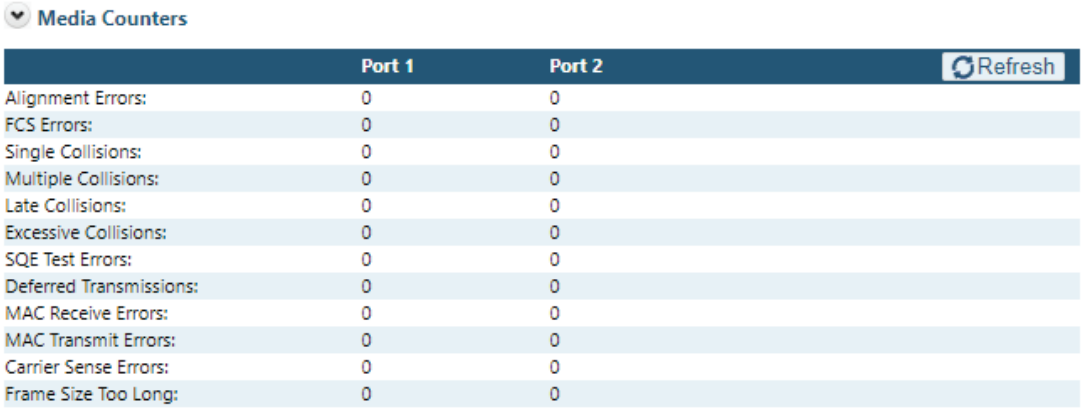


	Port 1	Port 2
In Octets:	5911139	0
In Ucast Packets:	164	0
In NUcast Packets:	55195	0
In Discards:	0	0
In Errors:	0	0
In Unknown Protos:	481	0
Out Octets:	31878	0
Out Ucast Packets:	142	0
Out NUcast Packets:	19	0
Out Discards:	0	0
Out Errors:	0	0

Figure 6–6: *GENESYS*™ Interface Counters View

6.5.3 Media Counters View

Media Counters view provides general information related to media input output counters. These counters summarize TCP protocol media errors.



	Port 1	Port 2
Alignment Errors:	0	0
FCS Errors:	0	0
Single Collisions:	0	0
Multiple Collisions:	0	0
Late Collisions:	0	0
Excessive Collisions:	0	0
SQE Test Errors:	0	0
Deferred Transmissions:	0	0
MAC Receive Errors:	0	0
MAC Transmit Errors:	0	0
Carrier Sense Errors:	0	0
Frame Size Too Long:	0	0

Figure 6–7: *GENESYS*™ Media Counters View

6.5.4 MODBUS TCP Statistics View

MODBUS TCP Statistics view provides general information related to MODBUS TCP packets transfer. These counters summarize MODBUS TCP protocol errors.

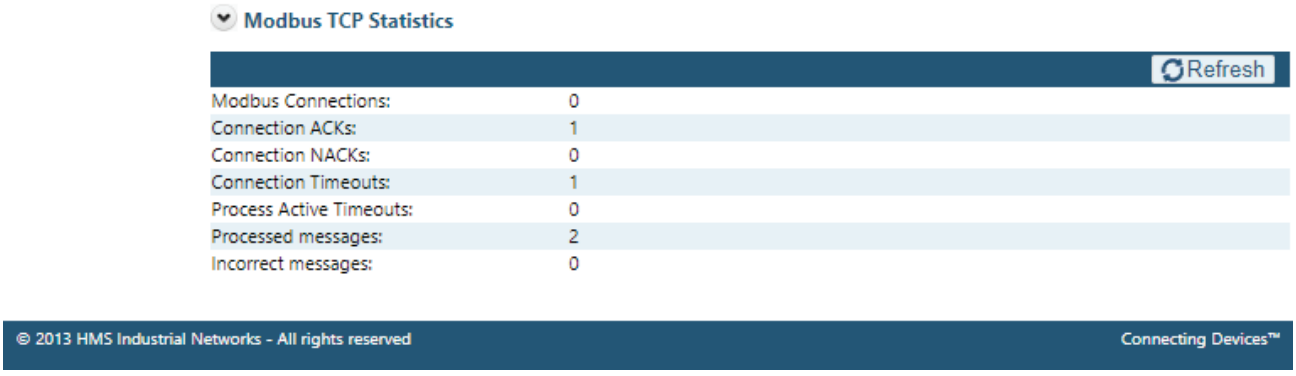


Figure 6–8: *GENESYS*™ MODBUS TCP Statistics View

6.6 NETWORK Configuration Page

The Configuration page provides the ability to modify Ethernet configuration parameters.

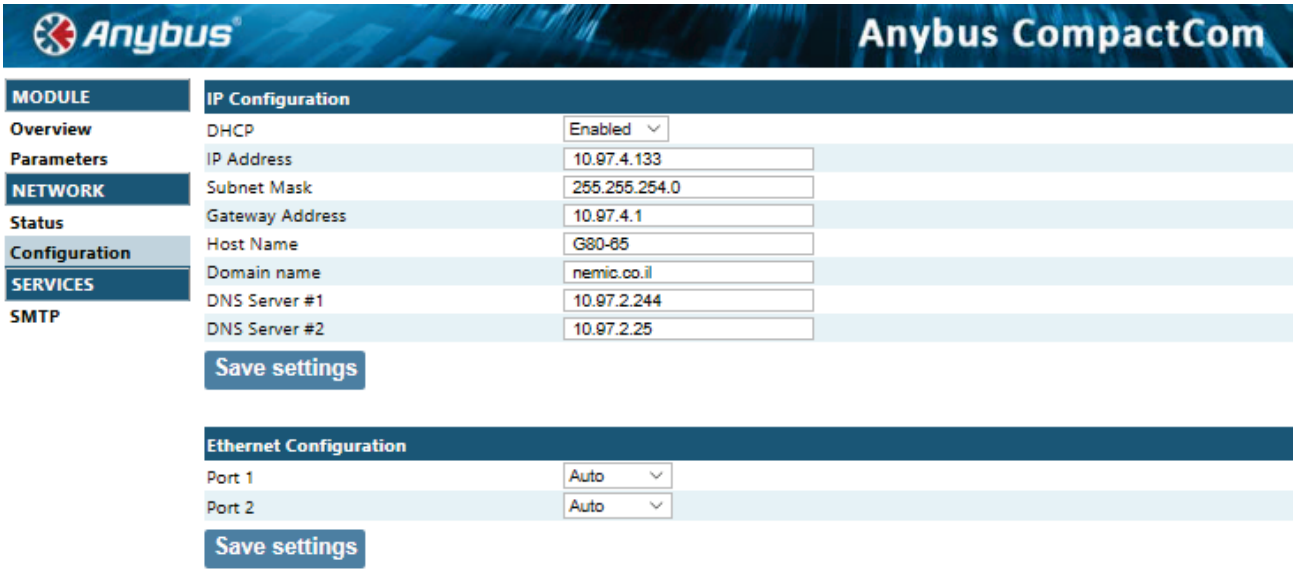


Figure 6–9: *GENESYS*™ Network Configuration View

IP Configuration section provides the ability to Enable/Disable DHCP (Dynamic Host Configuration Protocol). If DHCP is Enabled, IP Address, Subnet Mask, Gateway Address, Domain Name, DNS (Domain Name System) Server #1, and DNS Server #2 are defined automatically by DHCP server. If DHCP server is Disabled, all the above can be set manually.

Hostname may be used instead of the IP address to make a connection if the network supports DNS service for name translation. You may enter a custom name that describes the power supply in a meaningful way.

Ethernet Configuration section provides the ability to configure Port 1 and Port 2 with the following options:

- Auto – Auto Negotiation enabled. Speed and duplex are configured automatically according to the network the power supply is connected to.
- 10 HDX – 10Mbps, Half Duplex configuration.
- 10 FDX – 10Mbps, Full Duplex configuration.
- 100 HDX – 100Mbps, Half Duplex configuration.
- 100 FDX – 100Mbps, Full Duplex configuration.

NOTES

1. Default settings after reset are DHCP Enable, Hostname is set according to Section 4.5 and Port 1 and 2 set to Auto.
2. Any setting change must be acknowledged by Save settings button.
3. Some fields (DHCP setting, IP address setting, etc.) require AC power recycle if modified. It is mandatory to follow the instructions displayed on-screen following Save settings button press. It is recommended to recycle power supply AC power following any change.
4. If a parameter has been changed, it is recommended to wait for 5 to 10 seconds following a press on Save settings button to ensure parameters have been accepted by the power supply (on-screen instructions might not appear).
5. Some IP addresses might be blocked by the web page. In such case, set IP address through power supply front panel (there are no restrictions if an IP address is set through power supply front panel). Refer to Section 5.2.

6.7 SERVICES SMTP Page

The SMTP page provides the ability to set Simple Mail Transfer Protocol, this service is not implemented.

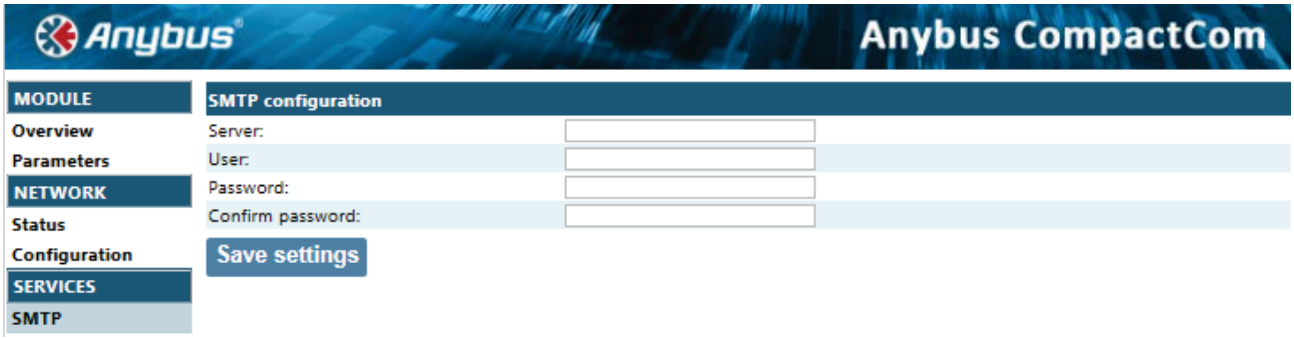


Figure 6–10: GENESYS™ Services SMTP View

CHAPTER 7: PROGRAMMING USING SOCKETS

7.1 Socket Description

GENESYS™ MODBUS TCP offers socket connections. Socket is a low-level protocol that is universally available in all operating systems and programming environments.

7.2 Communicating Using Sockets

Communicating through sockets involves opening a socket connection, sending commands (MODBUS TCP register address, and parameter), and reading the responses. The function by which a programming language manages the socket is the TCP stack.

There is a single socket, TCP protocol, which may be used at port 502.

7.3 Controller Access

Up to 4 TCP socket connections can be opened at the same time.

NOTES

1. The performance of the ***GENESYS™*** MODBUS TCP interface is impacted as more web pages and sockets are open at the same time.
2. Multi-User control is not allowed in Multi-Drop configuration (power supplies are connected by Daisy-Chain RS485 connection).

7.4 Input Buffer Requirements

With a controller using TCP sockets, the power supply can receive commands much faster than it can process. To make sure the ***GENESYS™*** MODBUS TCP interface is not overloaded, it is required that the controller sometimes sends a query and then waits for the response. The response is the acknowledgement from the power supply that it has finished processing all commands.

It is recommended that your controller routinely sends “SYST:ERR?” query (Register 935). This query takes about 60 to 80 mSec and verifies that all commands have been accepted correctly.

NOTE

Timeout - If there is no active communication within one minute period, TCP connection is automatically closed. A new socket connection should be established to communicate with the power supply.

CHAPTER 8: CONNECTING OVER WAN

To connect over the Wide Area Network (i.e., the global internet), the following settings must be made in the network server.

8.1 View Web Pages Over WAN

The ***GENESYS™*** power supply MODBUS TCP interface has a server for running the web pages. The web server is listening in Port 80.

The network administrator must obtain and assign a Global IP for the power supply. On the network server, the network administrator also must ensure port 80 is exposed to WAN connectivity.

8.2 Use Sockets Over WAN

The network administrator must obtain and assign a Global IP for the power supply. On the network server, the network administrator also must ensure port 502 (for TCP sockets) is exposed to WAN connectivity.

CHAPTER 9: MODBUS TCP DATA STRUCTURE

9.1 Programming / Monitoring Values Translation

MODBUS TCP communication interface preserves power supply resolution and accuracy, according to specifications.

Programming / Monitoring values are represented in a form of 16 bits unsigned integer value. Rated Voltage, Current, and Power (nominal values) are represented as 53620 in a decimal base or 0xD174 in a hexadecimal base.

For example, 10 Volts, 500 Amperes, 5000 Watts power supply programming and monitoring values are represented as follows: 10 Volts = 53620, 2 volts = 10724 = 0x29E4

500 Amperes = 53620, 400 Amperes = 42896 = 0xA790

5000 Watts = 53620, 2500 Watts = 26810 = 0x68BA

600 Volts, 2.8 Amperes, 1680 Watts power supply programming and monitoring values are represented as follows: 600 Volts = 53620, 100 Volts = 8937 = 0x22E9

2.8 Amperes = 53620, 2 Amperes = 38300 = 0x959C

1680 Watts = 53620, 680 Watts = 21703 = 0x54C7

Voltage, Current, and Power values are limited to 105% (0xDBED) programming range. Protection functions such as OVP are model dependent, ranging from 110% (0xE666) up to 120% (0xFB58) according to model specifications (refer to power supply Instruction Manual).

NOTE

Values translation from real number (voltage, current, power, etc.) into unsigned 16 bits integer (hexadecimal) representation may require rounding. Round naturally to the nearest unsigned 16 bits representation.

Translation formula from actual value to programming / monitoring hexadecimal value is as follows:

$$hexadecimal\ value = \frac{actual\ programming\ or\ monitoring\ value}{rated\ (nominal)\ value} * 53620$$

Translation formula from programming / monitoring hexadecimal value to actual value is as follows:

$$actual\ programming\ or\ monitoring\ value = \frac{hexadecimal\ value}{53620} * rated(nominal)value$$

NOTE

Decimal 53620 value is represented as 0xD174 hexadecimal value. Formulas above are shown in Decimal base. Power supply operates with hexadecimal values.

9.2 Data Type

MODBUS TCP communication interface utilizes four data types: char, uint16, uint32, and float. Each register holds 16 bits of data.

Char data type is used for strings represented as ASCII characters. Size of char is 1 byte.

Char data type example - *IDN? query (address 3, 100 bytes, 50 registers) for 100 Volts, 50 Amperes power supply: TDK-LAMBDA,G100-50-MODBUS,12345-123456,G:02.000.

Register Address	ASCII Characters	Hexadecimal Data
3	TD	5444
4	K-	4B2D
5	LA	4C41
6	MB	4D42
7	DA	4441
8	,G	2C47
9	10	3130
10	0-	302D
11	50	3530
12	-M	2D4D
13	OD	4F44
14	BU	4255
15	S,	532C
16	12	3132
17	34	3334
18	5-	352D
19	12	3132
20	34	3334
21	56	3536
22	,G	2C47
23	:0	3A30
24	2.	322E
25	00	3030
26	00 *	3030 *

NOTES

1. * Last 0 is added as the initial register value is 0, this value is not part of the *IDN? string.
2. Always start register access from the first register address according to commands mapping table (refer to Section 9.7) for each command / query. Access to any other register won't represent the actual data. For example, for *IDN? query, always read from address 3.
3. Registers 27–52 contain 0.

Uint16 data type is the most common type used for most of the functions. Size of uint16 is 2 bytes.

Uint16 data type example – MEASure:VOLTage[:DC]? query (address 78, 2 bytes, 1 register) for 100 Volts actual output value in a 100 Volts (nominal) power supply: 53620 = 0xD174

Register Address	Decimal value	Hexadecimal Data
78	53620	D174

Uint32 data type is used to query power supply operation time. Size of uint32 is 4 bytes.

Uint32 data type example – SYSTem:PON:TIME? query (address 997, 4 bytes, 2 registers). 100 hours operation time is represented as:

Register Address	Decimal value	Hexadecimal Data
997	100	0064
998	0	0000

Float data type is used for sequencer time / dwell programming and voltage / current slew rate control. Size of float is 4 bytes, represented according to IEEE 754 standard.

Float data type example – [PROGram]:LIST:DWELl? query (address 195, 400 bytes, 200 registers). One second dwell for a single sequence point is represented as: 0x3F800000. Rest of the cells contain 0 if not used.

Register Address	Decimal value	Hexadecimal Data
195	0	0000
196	16256	3F80

NOTES

1. Always start register access from the first register address according to commands mapping table (refer to Section 9.7) for each command / query. Access to any other register won't represent the actual data. For example for [PROGram]:LIST:DWELl? query, always read from address 195.
2. First sequencer point always starts at the first register address.

9.3 Data Access

MODBUS TCP supports three types of data access operations: Read, Write, and Read/Write. Query commands (registers) have Read access only.

NOTES

1. Register which don't have Read access return 0.
2. Write of an out-of-range value results in an error. It is recommended to read register 935 (SYSTem:ERRor? query) to verify no errors.

9.4 Data Length (Number of Registers)

Each register length is 2 bytes. Read/Write of multiple registers results in Read/Write of a set of bytes multiplied by two. For example, *IDN? query start from register address 3, its length is 50 registers, 100 bytes.

NOTE

Always start register access from the first register address according to commands mapping table (refer to Section 9.7) for each command / query. Access to any other register won't represent the actual data.

9.5 Parameters Range

Each command (register) has a specified data range. It is mandatory to preserve data range to avoid data overrun. For example, voltage setting range is 0 up to 105% of rated (nominal) value, translated to 0x0000 up to 0xDBED. An out-of-range parameter generates an error, which can be read by register 935 (SYSTem:ERRor? query).

Some other registers (commands) such as register 1 (*ESE command), are limited to a specific range, 0 up to 255. A value out of the specified range might result in an unexpected setting value.

NOTE

It is recommended to follow parameters range specification to avoid an unexpected behavior of a power supply.

9.6 Read / Write Registers

GENESYS™ MODBUS TCP supports three types of Read / Write operations. Read holding registers, Write single register, and Write multiple registers. Each operation is defined per command (per register or registers range). Operation Function Code defines operation type.

Operation Name	Operation Function Code	Description
Read holding registers	0x03	Read a set of subsequent registers
Write single register	0x06	Write single (one) register
Write multiple registers	0x10	Write a set of subsequent registers

NOTE

Read / Write coils (operation function codes 0x01 and 0x05) operations are not supported

9.7 Registers Mapping

MODBUS TCP registers are mapped according to the table below. Refer to ***GENESYS™*** USER MANUAL (IA761-04-02_) for information regarding commands functionality.

Register address	Read holding registers (0x03)	Write single register (0x06)	Write multiple registers (0x10)	Parameter range	SCPI command	Read / Write	Data type	Number of registers
0		V		0,1	*CLS	W	uint16	1
1	V	V		0–255	*ESE	RW	uint16	1
2	V			0–255	*ESR?	R	uint16	1
3	V			ASCII	*IDN?	R	char	50
53	V	V		0,1	*OPC	RW	uint16	1
54	V			0–255	*OPT?	R	uint16	1
55	V	V		0,1	*PSC	RW	uint16	1
56		V		1–4	*RCL	W	uint16	1
57		V		0,1	*RST	W	uint16	1
58		V		1–4	*SAV	W	uint16	1
59	V	V		0–255	*SRE	RW	uint16	1
60	V			0–255	*STB?	R	uint16	1
61		V		0,1	*TRG	W	uint16	1
62	V			0,1	*TST?	R	uint16	1
63		V		0,1	*WAI	W	uint16	1
64		V		0,1	ABORt	W	uint16	1
65	V	V		0,1	DISPlay[:WINDow]:STATe	RW	uint16	1
66	V	V		0,1	DISPlay[:WINDow]:FLASh	RW	uint16	1
67		V		0,1	DISPlay[:WINDow]:TEST	W	uint16	1
68		V		0,1	INITiate[:IMMediate]	W	uint16	1
69	V	V		0,1	INITiate:CONTinuous	RW	uint16	1
70		V		0,1	INSTrument:COUPle	W	uint16	1
71	V	V		0–31	INSTrument:[N]SELect	RW	uint16	1
72		V		1–4	GLOBal:*RCL	W	uint16	1
73		V		0,1	GLOBal:*RST	W	uint16	1
74		V		1–4	GLOBal:*SAVe	W	uint16	1
75		V		0–53620	GLOBal:CURRent[:AMPLitude]	W	uint16	1
76		V		0,1	GLOBal:OUTPut[:STATe]	W	uint16	1
77		V		0–53620	GLOBal:VOLTage[:AMPLitude]	W	uint16	1

Register address	Read holding registers (0x03)	Write single register (0x06)	Write multiple registers (0x10)	Parameter range	SCPI command	Read / Write	Data type	Number of registers
78	V			0–53620	MEASure:VOLTage[:DC]?	R	uint16	1
79	V			0–53620	MEASure:CURRent[:DC]?	R	uint16	1
80	V			0–53620	MEASure:POWer[:DC]?	R	uint16	1
81	V	V		0,1	OUTPut[:STATe]	RW	uint16	1
82	V	V		0,1	OUTPut:ENA[:STATe]	RW	uint16	1
83	V	V		0,1	OUTPut:ENA:POLarity	RW	uint16	1
84	V	V		0,1	OUTPut:ILC[:STATe]	RW	uint16	1
85	V			1–4	OUTPut:MODE?	R	uint16	1
86	V	V		0,1	OUTPut:PON[:STATe]	RW	uint16	1
87		V		0,1	OUTPut:PROTection:CLEar	W	uint16	1
88	V	V		0–2	OUTPut:PROTection:FOLDback[:MODE]	RW	uint16	1
89	V	V		1–255	OUTPut:PROTection:FOLDback:DELay	RW	uint16	1
90	V	V		0,1	OUTPut:RELay1[:STATe]	RW	uint16	1
91	V	V		0,1	OUTPut:RELay2[:STATe]	RW	uint16	1
92	V	V		0–2	OUTPut:TTLTrg:MODE	RW	uint16	1
93	V	V		0,1–9999	[PROGram]:COUNter	RW	uint16	1
94	V	V	V	0–53620	[PROGram]:LIST:CURRent	RW	uint16	100
194		V	V	0,1	Upload [PROGram]:LIST:CURRent registers	W	uint16	1
195	V	V	V	0.001–129600	[PROGram]:LIST:DWELl	RW	float	200
395		V	V	0,1	Upload [PROGram]:LIST:DWELl registers	W	uint16	1
396	V	V	V	0–53620	[PROGram]:LIST:VOLTage	RW	uint16	100
496		V	V	0,1	Upload [PROGram]:LIST:VOLTage registers	W	uint16	1
497	V	V		1–4	[PROGram]:LOAD	RW	uint16	1
498	V	V		0,1	[PROGram]:STEP	RW	uint16	1
499		V		1–4	[PROGram]:STORe	W	uint16	1
500	V	V	V	0–53620	[PROGram]:WAVE:CURRent	RW	uint16	100
600		V	V	0,1	Upload [PROGram]:WAVE:CURRent registers	W	uint16	1
601	V	V	V	0.001–129600	[PROGram]:WAVE:TIME	RW	float	200
801		V	V	0,1	Upload [PROGram]:WAVE:TIME registers	W	uint16	1
802	V	V	V	0–53620	[PROGram]:WAVE:VOLTage	RW	uint16	100
902		V	V	0,1	Upload [PROGram]:WAVE:VOLTage registers	W	uint16	1
903	V	V	V	0–100	Number of the points	RW	uint16	1
904	V	V		0–53620	[SOURce]:VOLTage[:LEVel][:IMMediate][:AMPLitude]	RW	uint16	1
905	V	V		0–53620	[SOURce]:CURRent[:LEVel][:IMMediate][:AMPLitude]	RW	uint16	1
906	V	V		0–64342	[SOURce]:VOLTage:PROTection:LEVel	RW	uint16	1
907	V	V		1–255	[SOURce]:VOLTage:PROTection:LOW:DELay	RW	uint16	1
908	V	V		0,1	[SOURce]:VOLTage:PROTection:LOW:STATe	RW	uint16	1

Register address	Read holding registers (0x03)	Write single register (0x06)	Write multiple registers (0x10)	Parameter range	SCPI command	Read / Write	Data type	Number of registers
909	V	V		0–51065	[SOURce]:VOLTage:PROTection:LOW[:LEVel]	RW	uint16	1
910	V	V	V	0.0001–999.99	[SOURce]:CURRent:SLEW:DOWN	RW	float	2
912	V	V	V	0.0001–999.99	[SOURce]:CURRent:SLEW:UP	RW	float	2
914	V	V	V	0.0001–999.99	[SOURce]:VOLTage:SLEW:DOWN	RW	float	2
916	V	V	V	0.0001–999.99	[SOURce]:VOLTage:SLEW:UP	RW	float	2
918	V	V		0,1	[SOURce]:POWer:STATe	RW	uint16	1
919	V	V		1–53620	[SOURce]:POWer[:LEVel]	RW	uint16	1
920	V	V		0,1,2	[SOURce]:VOLTage:MODE	RW	uint16	1
921	V	V		0,1,2	[SOURce]:VOLTage:EXTernal:MODE	RW	uint16	1
922	V	V		0,1,2	[SOURce]:CURRent:MODE	RW	uint16	1
923	V	V		0,1,2	[SOURce]:CURRent:EXTernal:MODE	RW	uint16	1
924	V	V		0,1	[SOURce]:CURRent:EXTernal:LIMit[:STATe]	RW	uint16	1
925	V			0–65535	STATus:OPERation[:EVENt]?	R	uint16	1
926	V			0–65535	STATus:OPERation:CONDition?	R	uint16	1
927	V	V		0–65535	STATus:OPERation:ENABle	RW	uint16	1
928	V			0–65535	STATus:QUEStionable[:EVENt]?	R	uint16	1
929	V			0–65535	STATus:QUEStionable:CONDition?	R	uint16	1
930	V	V		0–65535	STATus:QUEStionable:ENABle	RW	uint16	1
931	V	V		0–31	SYSTem[:COMMunicate]:ADDRess	RW	uint16	1
932	V			9600–115200	SYSTem[:COMMunicate]:BAUDrate?	R	uint16	1
933	V	V		0–4	SYSTem[:COMMunicate]:INTerface	RW	uint16	1
934		V		0,1	SYSTem:ERRor:ENABle	W	uint16	1
935	V			ASCII	SYSTem:ERRor?	R	char	30
965		V		1–5	SYSTem:FRST	W	uint16	1
966	V			ASCII	SYSTem:FIRMware[:VERSion]?	R	char	30
996	V			0,1	SYSTem:PANel:LOCK?	R	uint16	1
997	V			0-4294967295	SYSTem:PON:TIME?	R	uint32	2
999	V			0-4294967295	SYSTem:PON:TIME:AC?	R	uint32	2
1001	V	V		0,1	SYSTem:PRELoad[:STATe]	RW	uint16	1
1002	V	V		0–10000	SYSTem:PSOK:DELay	RW	uint16	1
1003	V	V		0,1	SYSTem:RANGe	RW	uint16	1
1004	V	V		1–1000	SYSTem:RIN[:LEVel]	RW	uint16	1
1005	V	V		0,1	SYSTem:RIN:STATe	RW	uint16	1
1006	V	V		0,1,2	SYSTem:REMote[:STATe]	RW	uint16	1
1007	V	V		0,1	SYSTem:SENSe[:STATe]	RW	uint16	1
1008	V	V		0,1,2	SYSTem:SLEW[:STATe]	RW	uint16	1
1009	V			0–65535	SYSTem:TEMPerature[:AMBient]?	R	uint16	1

Register address	Read holding registers (0x03)	Write single register (0x06)	Write multiple registers (0x10)	Parameter range	SCPI command	Read / Write	Data type	Number of registers
1010		V		0,1	TRIGger[:IMMediate]	W	uint16	1
1011	V	V		0–10000	TRIGger:DELay	RW	uint16	1
1012	V	V		0,1	TRIGger:SOURce	RW	uint16	1
1013		V		0,1	SYSTem:PARallel:ACKNowledge	W	uint16	1
1014	V			ASCII	SYSTem:DATE?	R	char	7
1021	V	V		0,1	SYSTem[:COMMunicate]:WATCHdog:STATe	RW	uint16	1
1022	V	V		1–3600	SYSTem[:COMMunicate]:WATCHdog:TIMe	RW	uint16	1
1023	V			ASCII	SYSTem:PARallel?	R	char	6
1029	V	V		0,1	SYSTem:PSINk[:STATe]	RW	uint16	1

NOTES

1. Size of each register: 2 bytes.
2. An out-of-range parameter might result in an unpredicted behavior of the power supply.
3. Reading holding registers which have no Read access return 0.
4. Some special functions commands are available in SCPI only, therefore not mapped in the table above.
5. Registers which accept parameters in the range of 0,1, accept 0 as logical 0, while any number above 0 accepted as logical 1 (acts as Boolean parameter).
6. Loading a value above uint16 (above 65535) loads only 16 LSB of the value.
7. Power supply must be addressed to establish communication by INSTrument:[N]SELect command (register 71). If commands are sent to a non-selected supply, the reply is not predicted. By default, following MODBUS TCP interface selection, power supply is automatically addressed. If power supply address is changed by SYSTem[:COMMunicate]:ADDRess command (register 931), power supply must be addressed by INSTrument:[N]SELect command (register 71). Be aware that registers memory is preserved, even if power supply is not selected. It is mandatory to re-send corresponding register address to ensure accurate contents, following power supply selection. INSTrument:[N]SELect query (register 71) will always return the last addressed supply, even if a non-existing supply has been addressed (e.g., if power supply with address 10 does not exist as a master or as a daisy-chained supply, a query of INSTrument:[N]SELect will return 10 if INSTrument:[N]SELect 10 was previously sent).
8. Registers 1021, 1022, and 1023 are available from Modbus-TCP firmware revision 2.009 & above.
9. Register address 497 ([PROGram]:LOAD) returns 0 if a program was not previously loaded.
10. Register 1024 is available from Modbus-TCP firmware revision 2.012 & above.

9.8 MODBUS TCP Unique Commands Structure

Some MODBUS TCP commands have unique functionality compared to SCPI commands, due to limited registers operations. These commands are described in this section (All other commands' parameters / return values are according to User Manual. Refer to ***GENESYS***™ USER MANUAL (IA761-04-02_), SCPI commands for functionality explanation.

***CLS**

Parameter	To activate, write 0x0001 as parameter.

***OPC**

Parameter	To activate, write 0x0001 as parameter.

***OPT?**

Returns	Returns 2 for MODBUS TCP interface.

***RST**

Parameter	To activate, write 0x0001 as parameter.

***TRG**

Parameter	To activate, write 0x0001 as parameter.

***WAI**

Parameter	To activate, write 0x0001 as parameter.

ABORt

Parameter	To activate, write 0x0001 as parameter.

INITiate[:IMMediate]

Parameter	To activate, write 0x0001 as parameter.

INSTrument:COUPle

Parameter	NONE – write 0x0000; ALL - write 0x0001 as parameter.

GLOBAL:*RST

Parameter	To activate, write 0x0001 as parameter.

OUTPut:ENA:POLarity

Parameter	REV - 0x0000; NORM – 0x0001 as return value.

OUTPut:MODE?

Return	OFF - 0x0001; CV – 0x0002; CC - 0x0003; CP – 0x0004 as return value.

OUTPut:PON[:STATe]

Parameter	SAFE - 0x0000; AUTO – 0x0001 as return value.

OUTPut:PROTection:CLEar

Parameter	To activate, write 0x0001 as parameter.

OUTPut:PROTection:FOLDback[:MODE]

Parameter	OFF - 0x0000; CC – 0x0001; CV - 0x0002 as return value.

OUTPut:PROTection:FOLDback:DELay

Unit	100mSec. Multiply register value by 100mSec. For example: 1 equals 100mSec; 5 equals 500mSec.

OUTPut:TTLTrg:MODE

Parameter	OFF - 0x0000; FSTR – 0x0001; TRIG - 0x0002 as return value.

[PROGram]:COUNter

Parameter	INFinity – write 0x0000; Number of iterations - write 1–9999 as parameter. Any value above 9999 results in INFinity.

[PROGram]:LIST:CURRent

Parameter	Each value is loaded into a single register. Refer to Section 9.9 for an example of Voltage registers.

Upload [PROGram]:LIST:CURRent registers

Specific	MODBUS TCP specific command used to upload [PROGram]:LIST:CURRent into power supply. Refer to Section 9.9 for an example of Voltage registers.

[PROGram]:LIST:DWELl

Parameter	Each value is loaded into a pair of registers. Low address value holds the least significant part. Refer to Section 9.9 for an example.

Upload [PROGram]:LIST:DWELl registers

Specific	MODBUS TCP specific command used to upload [PROGram]:LIST:DWELl into power supply. Refer to Section 9.9 for an example.

[PROGram]:LIST:VOLTage

Parameter	Each value is loaded into a single register. Refer to Section 9.9 for an example.

Upload [PROGram]:LIST:VOLTage registers

Specific	MODBUS TCP specific command used to upload [PROGram]:LIST:VOLTage into power supply. Refer to Section 9.9 for an example.

[PROGram]:STEP

Parameter	ONCE – write 0x0000; AUTO - write 0x0001 as parameter.

[PROGram]:WAVE:CURRent

Parameter	Each value is loaded into a single register. Refer to Section 9.9 for an example of List Voltage registers.

Upload [PROGram]:WAVE:CURRent registers

Specific	MODBUS TCP specific command used to upload [PROGram]:WAVE:CURRent into power supply. Refer to Section 9.9 for an example of LIST Voltage registers.

[PROGram]:WAVE:TIME

Parameter	Each value is loaded into a pair of registers. Low address value holds the least significant part. Refer to Section 9.9 for an example of List Dwell registers.

Upload [PROGram]:WAVE:TIME registers

Specific	MODBUS TCP specific command used to upload [PROGram]:WAVE:TIME into power supply. Refer to Section 9.9 for an example of List Dwell registers.

[PROGram]:WAVE:VOLTage

Parameter	Each value is loaded into a single register. Refer to Section 9.9 for an example of List Voltage registers.

Upload [PROGram]:WAVE:VOLTage registers

Specific	MODBUS TCP specific command used to upload [PROGram]:LIST:VOLTage into power supply. Refer to Section 9.9 for an example List Dwell registers.

Number of the points

Parameter	MODBUS TCP specific command used to set the number of points of a sequence to load into a power supply. Refer to Section 9.9 for an example.

[SOURce]:VOLTage:PROTection:LOW:DELay

Unit	100mSec. Multiply register value by 100mSec. For example: 1 equals 100mSec; 5 equals 500mSec.

[SOURce]:CURRent:SLEW:DOWN

Parameter	Each value is loaded into a pair of registers. Low address value holds the least significant part.

[SOURce]:CURRent:SLEW:UP

Parameter	Each value is loaded into a pair of registers. Low address value holds the least significant part.

[SOURce]:VOLTage:SLEW:DOWN

Parameter	Each value is loaded into a pair of registers. Low address value holds the least significant part.

[SOURce]:VOLTage:SLEW:UP

Parameter	Each value is loaded into a pair of registers. Low address value holds the least significant part.

[SOURce]:VOLTage:MODE

Parameter	NONE - 0x0000; LIST - 0x0001; WAVE - 0x0002 as return value.

[SOURce]:VOLTage:EXTernal:MODE

Parameter	DIG - 0x0000; VOL - 0x0001; RES - 0x0002 as return value.

[SOURce]:CURRent:MODE

Parameter	NONE - 0x0000; LIST - 0x0001; WAVE - 0x0002 as return value.

[SOURce]:CURRent:EXTernal:MODE

Parameter	DIG - 0x0000; VOL - 0x0001; RES - 0x0002 as return value.

SYSTem[:COMMunicate]:BAUDrate?

Return	9600 - 0x0000; 19200 - 0x0001; 38400 - 0x0002; 57600 - 0x0003; 115200 - 0x0004 as return value.

SYSTem[:COMMunicate]:INTerface

Parameter	RS232 - 0x0000; RS485 - 0x0001; LAN - 0x0002; USB - 0x0003; OPT - 0x0004.

SYSTem:ERRor:ENABle

Parameter	To activate, write 0x0001 as parameter.

SYSTem:FRST

Parameter	USB - 0x0001; RS232 - 0x0002; RS485 - 0x0003; LAN - 0x0004; OPT - 0x0005.

SYSTem:PSOK:DELay

Unit	mSec. Data is represented in milliseconds. For example: 1 equals 1mSec; 1000 equals 1Sec.

SYSTem:RANGe

Parameter	5 Volts range - 0x0000; 10 Volts range – 0x0001 as return value.

SYSTem:RIN[:LEVel]

Unit	mOhms. Data is represented in milliohms. For example: 1 equals 1mohm; 1000 equals 1ohm.

SYSTem:REMote[:STATe]

Parameter	LOC - 0x0000; REM - 0x0001; LLO - 0x0002 as return value.

SYSTem:SENSe[:STATe]

Parameter	LOC - 0x0000; REM - 0x0001 as return value.

SYSTem:SLEW[:STATe]

Parameter	OFF - 0x0000; VOLT - 0x0001; CURR - 0x0002 as return value.

TRIGger[:IMMediate]

Parameter	To activate, write 0x0001 as parameter.

TRIGger:DELay

Unit	mSec. Data is represented in milliseconds. For example: 1 equals 1mSec; 1000 equals 1Sec.

TRIGger:SOURce

Parameter	BUS - 0x0000; EXT - 0x0001 as return value.

SYSTem:PARallel:ACKNowledge

Parameter	To activate, write 0x0001 as parameter.

NOTES

1. LAN specific commands are not available for MODBUS TCP interface.
2. SYSTEM[:COMMunicate]:LANGuage command is not available for MODBUS TCP interface.
3. SYSTem:VERSion? command is not available for MODBUS TCP interface.
4. Read/Write commands (defined as RW) have the same set of Return and Parameter values, although defined as Parameter in the table above.

9.9 Sequencer Activation

This section describes how to activate basic sequencer operation. Refer to GENESYS™ USER MANUAL (IA761-04-02_) for general information regarding sequencer functionality combined with the trigger system.

For example, the following sequence should be programmed as follows:

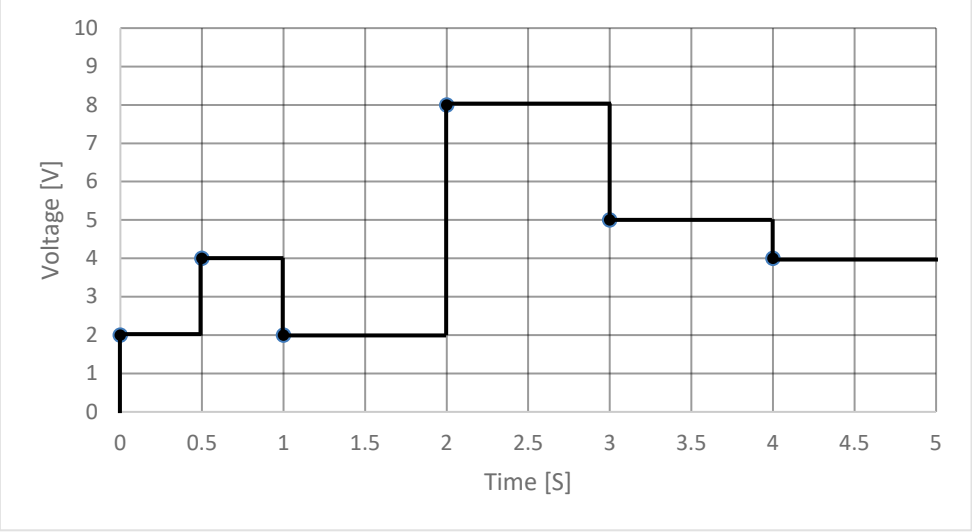


Figure 9–1: LIST Mode Example

SCPI programming language:

VOLT:MODE LIST	Select LIST Mode Sequence
LIST:VOLT 2,4,2,8,5,4	Set voltage values ”2,4,2,8,5,4” Volts
LIST:DWEL 0.5,0.5,1,1,1,1	Set dwell values ”0.5,0.5,1,1,1,1” Seconds
STEP AUTO	Set AUTO step execution mode ”AUTO”
COUN 1	Set list execution iterations ”1”
TRIG:SOUR BUS	Select BUS trigger source via communication interface or front panel
INIT:CONT OFF	Trigger system is enabled for a single trigger action
INIT	Trigger initialize
*TRG	Trigger command

MODBUS TCP Registers programming:

Write 0x0001 to register 920	Select LIST Mode Sequence
Write 0x29E4 to register 396	Set voltage value 2 Volts
Write 0x53C8 to register 397	Set voltage value 4 Volts
Write 0x29E4 to register 398	Set voltage value 2 Volts
Write 0xA790 to register 399	Set voltage value 8 Volts
Write 0x68BA to register 400	Set voltage value 5 Volts
Write 0x53C8 to register 401	Set voltage value 4 Volts
Write 0x0000 to register 195	Set dwell value 0.5 Second (low register)
Write 0x3F00 to register 196	Set dwell value 0.5 Second (high register)
Write 0x0000 to register 197	Set dwell value 0.5 Second (low register)
Write 0x3F00 to register 198	Set dwell value 0.5 Second (high register)

Write 0x0000 to register 199	Set dwell value 1 Second (low register)
Write 0x3F80 to register 200	Set dwell value 1 Second (high register)
Write 0x0000 to register 201	Set dwell value 1 Second (low register)
Write 0x3F80 to register 202	Set dwell value 1 Second (high register)
Write 0x0000 to register 203	Set dwell value 1 Second (low register)
Write 0x3F80 to register 204	Set dwell value 1 Second (high register)
Write 0x0000 to register 205	Set dwell value 1 Second (low register)
Write 0x3F80 to register 206	Set dwell value 1 Second (high register)
Write 0x0006 to register 903	Indicates to load 6 points (mutual for Voltage and Dwell)
Write 0x0001 to register 496	Upload Voltage registers into power supply sequencer
Write 0x0001 to register 395	Upload Dwell registers into power supply sequencer
Write 0x0001 to register 498	Set AUTO step execution mode ”AUTO”
Write 0x0001 to register 93	Set list execution iterations ”1”
Write 0x0000 to register 1012	Select BUS trigger source via communication interface or front panel
Write 0x0000 to register 69	Trigger system is enabled for a single trigger action
Write 0x0001 to register 68	Trigger initialize
Write 0x0001 to register 61	Trigger command

NOTES

1. Start condition: Assume power supply output is on; Initial voltage point is 0 Volts.
2. The example above demonstrates values for a 10 Volts rated power supply.

CHAPTER 10: MULTI DROP CONNECTION

One MODBUS TCP Interface can control more than one GENESYS™ power supply. A maximum of 31 units can be connected via RS485 interface to a power supply with the installed MODBUS TCP option.

The power supply connected to a PC via the Ethernet cable must be configured to MODBUS TCP (OPT) communication interface, the other units must be configured to RS485 interface. Each unit must have a unique address, ranging from 0 to 31. MODBUS TCP module automatically receives the address of the unit into which it is installed. For RS485 interface, set Baud rate to “115200" bps and Communication Language to "SCPI". Refer to GENESYS™ USER MANUAL (IA761-04-02_), Multi Power Supply Connection (Daisy-Chain) for instructions regarding system setup.

10.1 Selecting a Single Power Supply in a Multi Drop Chain

All MODBUS TCP commands may be sent to any one of the power supplies in RS485 chain by sending the INSTrument:NSELect <NR1> command (register 71). All commands and queries will then apply only to the selected power supply, until a new INSTrument:NSELect <NR1> command (register 71) is sent.

At power-up, the MODBUS TCP master power supply is automatically selected.

After sending INSTrument:NSELect <NR1> command (register 71), it is recommended to verify the command by sending INSTrument:NSELect? (read register 71), to make sure the following commands are not sent to the wrong power supply.

10.2 Power Supply Configuration

To communicate over the MODBUS TCP interface, power supply must be configured to MODBUS TCP. If MODBUS TCP option is installed, by default, power supply is pre-configured to the MODBUS TCP communication.

If, for any reason, MODBUS TCP communication is not selected, navigate to communication menu and select OPT. Refer to GENESYS™ USER MANUAL (IA761-04-02_) for instructions to set the MODBUS TCP (OPT) communication interface via the Front Panel or SYSTem:[COMMunicate]:INTerface <DSC> command to select communication interface by communication.

NOTE

Multi-User control is not allowed in Multi-Drop configuration (power supplies are connected by Daisy-Chain RS485 connection).

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