

SynQor Single Phase Full-brick PFIC Terminal Commands

The SynQor Single Phase Full-brick PFIC contains a serial port to facilitate system monitoring. This document applies to the following part numbers: MPFIC-U-xx-F[T,G]; APFIC-U-xx[R,D]-F[T,G]

Commands are sent to request individual data, the PFIC responds to each command individually.

The PFIC's external serial port IO pins are at 3.3V logic levels, not RS232 levels.

See the device datasheet for IO pin level & polarity details.

Commercial data converters are available to translate these levels to RS232 or USB.

The serial port uses 9600 baud, 8 data bits, no parity, and one stop bit. Commands can be sent, and output viewed, with any standard terminal emulator. The interface is case sensitive. To view user text, set the terminal emulator for local echo.

Some data are writeable; written values are, however, volatile and will revert to default upon power cycling.

A pause of >5 seconds between any two comand characters will timeout/reset the command parser. No response is generated.

This timeout value is user settable - see Hung Parser Timeout below.

The protocol supports communication to/from individual modules on a shared serial bus via a unique 'network address'.

(See the Enumerate command, available in models featuring a START SYNC control pin)

In this document, the symbol ␣ will be used to represent ascii 13 (cr) OR ascii 10 (lf) OR both (they're all equivalent).

Value Formats

Data supplied to, and returned from, the PFIC can be communicated in several formats, broadly divided into strings and numeric values. While strings are a unique type, numeric data can be further divided into serveral interchangeable formats.

Strings	Up to 64 ascii characters, and "enclosed in double quotes". A null string is "". Strings can contain unprintable and control characters which can, of course, affect the appearance of any terminal emulator receiving them.		
Numerical Formats	Fmt	Numeric Range	Description
	char	0 to 127	An ascii character, preceeded by single quote character ' to remove ambiguity. Responses using char format will always contain the ' prefix.
	hex	0x0 to 0xFFFF	0x and then zero to four ascii hex characters
	U int	0 to 65535	Unsigned decimal numeral, optionally preceeded by 'u'
	int	-32768 to 32767	Signed decimal numeral, specified by '+' or '-' prefix
mks	±###.##	Decimal numerals <i>containing a decimal point</i> are interpreted as real MKS values and are internally converted to/from machine units. MKS values are naturally signed. MKS format is recommended whenever referring to a real-life datum.	

Command Formats

Both data read and data write commands are supported

Data Write Command Syntax

{Net Addr}	{Access Address}	{Action Specifier}	{Write Value}	{Terminator}
m	0-127	=	"String" or 16-bit numerical	(cr) or (lf) or both, ␣

Net Addr: The network address character, which takes a default value of 'm on power-up. 'A thru 'z is a single unit's address, while '@ is interpreted as all units. To avoid collision, the response to '@ commands is automatically muted.

See the Enumerate command to automatically assign unique network addresses for multi-unit applications.

Access Addr: The address to write, see table below.

Addresses can be specified in char, hex, or int formats, see Value Formats below.

Action Specifier: The = character specifies a data write command.

Only select addresses are writeable.

Write Value: Values to write can be supplied in the formats described below;

The supplied format will determine the format of the response datum.

Terminator: a carriage return character (cr) = ascii 13, OR a linefeed character (lf) = ascii 10, OR both ␣.

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Data Read Command Syntax

{Net Addr}	{Access Address}	{Action Specifier}	[Format]	{Terminator}
m	0-127	?	optional value of 0	(cr) or (lf) or both, ↵

Net Addr: The network address character, which takes a default value of 'm' on power-up. while valid, the '@' address mutes responses to avoid collision; it's not useful for read operations. See the Enumerate command to automatically assign unique network addresses for multi-unit applications.

Access Addr: The address to read, see table below.

Addresses can be specified in char, hex, or int formats, see Value Formats below.

Action Specifier: The '?' character specifies a data read command.

Format: The numerical response datum format of a read command can be controlled by supplying the command with an argument value of 0. The format of the 0 specifies the desired return datum format (see table below). In the absence of a 0 argument, the datum is returned in its natural or mks format.

Terminator: a carriage return character (cr) = ascii 13, OR a linefeed character (lf) = ascii 10, OR both ↵.

Examples of controlling the return datum format of read commands

m46?↵	No value supplied, return datum in default (mks or natural) format
m46?0.↵	Value of 0 supplied in mks, return in mks/natural format
m46?.↵	
m46?0↵	Unsigned value of 0 supplied, return as unsigned int.
m46?u0↵	
m46?u↵	
m46?+0↵	Signed value of 0 supplied, return as signed int.
m46?+↵	
m46?0x↵	Value of 0 supplied in hex, return in hex.
m46?x↵	

Response Format

Immediately after reception of its terminator, each valid command generates a response.

Invalid commands do not generate a response.

Response Syntax

{Net addr}	{Access Address}	{Is Now}	{Value}	{Terminator}
m	0-127	=	"String" or 16-bit numerical	↵

Net Addr: The PFICs echoes its network address, 'm' in the example above.

Access Address: Echo of the address specifier in the same format as supplied.

Char addresses will be prefixed by '.

Is Now: The character '='

Value: The address's current value.

See above for descriptions of the return datum format to both read and write commands.

Char format will always contain leading ', hex format will always contain 0x and four ascii hex value characters.

Terminator: ↵ concludes the response

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Addresses

The following table contains a summary of the addresses that contain useful data.

Access Address			Name	Read / Write	Natural Format	Natural Units
hex,	dec,	or char				
0x0	0		ID String	R	string	
0x1	1		Part Number	R	string	
0x2	2		Serial Number	R	string	
0x2E	46	.	Code Revision	R	hex	Rev<<8 Subrev
0xD	13		Code Revision	R	string	
0x22	34	"	Hung Parser Timeout	R/W	##.##	seconds
0x23	35	#	Powered Days	R/W	int	days
0x24	36	\$	Powered Hours	R/W	int	hours
0x25	37	%	Powered Minutes	R/W	int	minutes
0x26	38	&	Powered Seconds	R/W	##.##	seconds
0x41	65	A	Auto Command String	R/W	string	
0x61	97	a	Auto Command Interval	R/W	##.##	seconds
0x46	70	F	AC Input Line Frequency	R	##.##	Hz
0x53	83	S	AC Input Voltage	R	###.##	Volts
0x73	115	s	PCB Temperature Near Boost Stage	R	##.###	°C
0x76	118	v	Output Voltage	R	##.###	Volts
0x74	116	t	PCB Temperature Near Isolation Stage	R	##.###	°C
0x50	80	P	Boost Stage Power	R	int	Watts
0x56	86	V	Hold-up Voltage	R	###.##	Volts
0x54	84	T	Highest PCB Temperature	R	##.###	°C
0x4D	77	M	Boost Stage Machine State	R	int	
0x4E	78	N	PFIC ENA Pin Override	R/W	int	
0x6E	110	n	Battle Short Mode Enable	R/W	int	
0x63	99	c	AC Line Status	R	hex	
0x67	103	g	Self Test Status	R	hex	
0x21	33	!	Net Address	R	quoted character	
0x45	69	E	Enumerate Network Address	R/W	int	
0x77	119	w	BS Warnings	R	hex	

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Address Details

Address:	hex	decimal	char
	0x0	0	
Name:	ID String		
Description:	The unit's ID string "SynQor Single Phase Isolated PFC"		
Response units:	string		
Read/Write:	Read Only		
Example Cmd:	Typical Response:		
m0x0?✓	m0x0000= "SynQor Single Phase Isolated PFC"✓		
m0?✓	m0= "SynQor Single Phase Isolated PFC"✓		

Address:	hex	decimal	char
	0x1	1	
Name:	Part Number		
Description:	The unit's part number		
Response units:	string		
Read/Write:	Read Only		
Example Cmd:	Typical Response:		
m0x1?✓	m0x0001= "MPFIC-U-28-FT"✓		
m1?✓	m1= "MPFIC-U-28-FT"✓		

Address:	hex	decimal	char
	0x2	2	
Name:	Serial Number		
Description:	The unit's serial number, factory assigned in sequential order		
Response units:	string		
Read/Write:	Read Only		
Example Cmd:	Typical Response:		
m0x2?✓	m0x0002= "S18844724"✓		
m2?✓	m2= "S18844724"✓		

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Address: hex decimal char
 0xD 13
Name: **Code Revision** as a string
Description: The unit's Code Revision
Response units: string
Read/Write: Read Only

Example Cmd:	Typical Response:
m0xD?↵	m0x000D= "v2.1"↵
m13?↵	m13= "v2.1"↵

Address: hex decimal char
 0x2E 46 .
Name: **Code Revision** as a number
Description: The unit's Code Revision
Natural Response units: hex
Read/Write: Read Only
Discussion: Code Revision is returned as MainRev<<8 | Subrev

Example Cmd:	Typical Response:	Interpretation:
m.?↵	m'.= 0x0201↵	0x0201 = 2<<8 1 Code Rev is 2.1
m.?0↵	m'.= 513↵	513 = 2*256 + 1 Code Rev is 2.1

Address: hex decimal char
 0x21 33 !
Name: **Net Address**
Description: Returns unit's Network Address as a quoted character
Natural Response units: quoted character, 'm by default
Read/Write: Read Only

Example Cmd:	Typical Response:
m0x21?↵	m0x0021= 'm'↵
m33?↵	m33= 'm'↵
m! ?↵	m '! = 'm'↵

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Address: hex decimal char
0x22 34 "

Name: Hung Parser Timeout

Description: The Hung Parser Timeout

Natural Response units: decimal seconds

Read/Write: Read/Write

Discussion: A delay of >N.N seconds between any two command characters will reset the command parser. This paramter controls the timeout value. It is both readable and writeable. Supplied in hex or int format, the units are integer 1/16ths of second. Supplied in MKS format, the units are decimal seconds.

Example Cmd:	Typical Responses:	Interpretation:
m0x22?✓	m0x0022= 5.00✓	Parser timeout is 5.00 seconds (default)
m"=60✓	m'"= 60✓	(Note int units supplied) Parser timeout set to 60/16 = 3.75 secs.
m"?✓	m'"= 3.75✓	Confirm 3.75 sec timeout in MKS units.
m34=60.✓	m34= 60.00✓	(Note MKS units supplied) Parser timout re-set to one minute

	hex	decimal	char	Response units	
Powered Days	0x23	35	#	int 0-65535	Read/Write
Powered Hours	0x24	36	\$	int 0-23	Read/Write
Powered Minutes	0x25	37	%	int 0-59	Read/Write
Powered Seconds	0x26	38	&	decimal 0-59.99	Read/Write

Discussion: Together these contain the number of days, hours, minutes and seconds that power has been applied. They can be written to any value (or cleared) at any time, and will count time thereafter.

Example Cmds:	Typical Responses:	Interpretation:
m35?✓	m35= 329✓	Unit has been powered for 329 days
m36?✓	m36= 3✓	and 3 hours.
m35=0✓	m35= 0✓	Days variable reset to 0.
m36=0✓	m36= 0✓	hours variable reset to 0.

Address: hex decimal char
0x41 65 A

Name: Auto Command String

Description: The Auto Command String will have the PFIC send the sama data repeatedly and automatically.

Response units: string

Read/Write: Read/Write

Discussion: The AutoCommandString is written to contain the exact commands to read the desired data. The string's contents are copied directly to the command parser input at an interval given by the Auto Command Interval, see below. This command should only be used with a single unit to avoid response data

Example Cmd:	Typical Responses:	Interpretation:
mA?✓	m'A= ""✓	The Auto Command String is empty.
mA="mS?✓mF?✓mP?"✓	m'A= "mS?✓mF?✓mP?"✓	Write the auto command string with: Read AC Input Voltage, Read AC Line Frequency, Read Boost Stage Power.

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Address: hex decimal char
0x61 97 a

Name: **Auto Command Interval**

Description: Controls how often the Auto Command String is executed.

Response units: decimal seconds

Read/Write: Read/Write

Discussion: A value of 0 (default) turns OFF Auto Command execution
The range of active values is from 1 to 65535 1/16ths of a second, a bit over an hour.
If the value is supplied in hex or int formats, the units are 1/16ths of a second
If the value is supplied in MKS format, the units are decimal seconds.

Example Cmd:	Typical Responses:	Interpretation:
ma?✓ ma=0.50✓	m'a= 0.00✓ m'a= 0.50✓	Auto Command is OFF Execute Auto Command String every half second

Address: hex decimal char
0x45 69 E

Name: **Enumerate Network Address**

Description: Enumeration automatically sets the network address of each unit in a multi-unit application.

Write Value Argument: The value of the **first** address to be auto-assigned (when after = sign, char format must include leading ').

Read Response value: The number of sequential addresses just assigned.

Read Response units: int

Read/Write: R/W

Discussion: At power-up, network address for each unit is reset to 'm. While that's sufficient for single-unit application: a response collision would occur if multiple units shared the default 'm address.
Upon receiving an Enumerate command, all addressed units will communicate over their interconnected StartSync line and assign themselves unique sequential network addresses.
Note that the units must be disabled to communicate over StartSync.
Enumerated addresses are volatile; they will revert to the default 'm whenever power is cycled.

Example Cmd:	Typical Responses:	Interpretation:
@E= 'A✓ AE?✓	none (response muted for global addr @) A'E=5✓	Enumerate network addresses, begin assignments at 'A Unit A, how many addrs were assigned. Answer=5
<i>Host now knows that there are 5 units on the network; their addresses are A, B, C, D, & E. Host can now communicate with them individually using any other command</i>		
A0x2?✓ B0x2?✓ C0x2?✓ D0x2?✓ E0x2?✓	A0x0002= "S17139017"✓ B0x0002= "S15930713"✓ C0x0002= "S17166150"✓ D0x0002= "S15922316"✓ E0x0002= "S15922317"✓	unit A: what is your serial number? unit B: what is your serial number? unit C: what is your serial number? unit D: what is your serial number? unit E: what is your serial number?

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Address: hex decimal char
 0x46 70 F
Name: **AC Input Line Frequency**
Description: The AC Line Frequency
Natural Response units: decimal Hz
Read/Write: Read Only
Discussion: Valid frequency range is 45 - 63 Hz and 360 - 800 Hz, response for invalid frequency is 0.00.

<u>Example Cmd:</u>	<u>Typical Responses:</u>	<u>Interpretation:</u>
m0x46?✓	m0x0046= 59.75✓	60 Hz
m70?✓	m70= 397.19✓	400 Hz
mF?✓	m'F= 794.38✓	800 Hz

Address: hex decimal char
 0x53 83 S
Name: **AC Input Voltage**
Description: The AC
Natural Response units: decimal Volts
Read/Write: Read Only
Discussion: The value is the rms L-N voltage.

<u>Example Cmd:</u>	<u>Typical Response:</u>	<u>Interpretation:</u>
mS?✓	m'S= 115.63✓	The L-N AC input voltage is 115 Vrms

Address: hex decimal char
 0x73 115 s
Name: **PCB Temperature Near Boost Stage**
Description: The unit's internal temperature near boost stage
Natural Response units: signed decimal °C
Read/Write: Read Only
Discussion: The measurement range is -40 °C to 125 °C, typical accuracy is ±1 °C.

<u>Example Cmd:</u>	<u>Typical Response:</u>	<u>Interpretation:</u>
mS?✓	m's= 30.176✓	The PFIC boost stage is at about 30 °C internally

Address: hex decimal char
 0x76 118 v
Name: **Output Voltage**
Description: Isolated output voltage
Natural Response units: decimal Volts DC
Read/Write: Read Only
Discussion:

<u>Example Cmd:</u>	<u>Typical Response:</u>	<u>Interpretation:</u>
mv?✓	m'v= 28.012✓	The output voltage is 28 VDC

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Address: hex decimal char
0x56 86 V

Name: **Hold-up Voltage**

Description: The Hold-up voltage

Response units: decimal Volts DC

Read/Write: Read Only

Discussion:

Example Cmd:
mV?↵

Typical Response:
m⁺V= 399.75↵

Interpretation:
The hold-up voltage is 400 VDC.

Address: hex decimal char
0x50 80 P

Name: **Boost Stage Power**

Description: The Boost stage power (for approximate output power, multiply by 0.95)

Natural Response units: Watts

Read/Write: Read Only

Discussion:

Example Cmd:
mP?↵

Typical Response:
m⁺P= 650↵

Interpretation:
The boost stage is delivering 650 W.

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Address:	hex decimal char 0x54 84 T
Name:	Highest PCB Temperature
Description:	The unit's highest internal PCB temperature
Natural Response units:	signed decimal °C
Read/Write:	Read Only
Discussion:	The measurement range is -40 °C to 125 °C, typical accuracy is ±1 °C.
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Example Cmd:	Typical Response:
<u>mT?</u> ✓	<u>m¹T= 30.176</u> ✓
	Interpretation:
	<u>The highest PCB temperature is at about 30 °C internally</u>

Address:	hex decimal char 0x74 116 t
Name:	PCB Temperature Near Isolation Stage
Description:	The unit's internal temperature near isolation stage
Natural Response units:	signed decimal °C
Read/Write:	Read Only
Discussion:	The measurement range is -40 °C to 125 °C, typical accuracy is ±1 °C.
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Example Cmd:	Typical Response:
<u>mt?</u> ✓	<u>m¹t= 37.059</u> ✓
	Interpretation:
	<u>The PFIC isolation stage is at about 37 °C internally</u>

Address:	hex decimal char 0x4D 77 M
Name:	Boost Stage Machine State
Description:	The present operational state number of the PFIC
Responses:	0 Waiting for all conditions to be ready to start 4 Soft Starting 5 Running 6 Waiting for auto-restart timeout Others Reserved
Natural Response units:	int
Read/Write:	Read Only
Discussion:	
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Example Cmd:	Typical Response:
<u>mM?</u> ✓	<u>m¹M= 3</u> ✓
	Interpretation:
	<u>The PFIC is Running</u>

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Address: hex decimal char
0x4E 78 N

Name: **PFIC ENA Pin Override**

Description: Allows overriding the PFIC ENA pin via serial interface

Response units: int

Read/Write: Read / Write

Discussion: value of 10 (0xA) allows unit operation to follow PFIC ENA pin [default]
writing value of 11 (0xB) overrides PFIC ENA pin and forces the unit ON
writing a value of 12 (0xC) overrides PFIC ENA pin and forces the unit OFF

<u>Example Cmd:</u>	<u>Typical Response:</u>	<u>Interpretation:</u>
mN?↵	m'N= 10↵	unit m is obeying PFIC ENA pin
@N=11↵	none (response muted for global addr @)	Everyone: Ignore PFIC ENA pin value and turn ON
mN=12↵	m'N= 12↵	unit m, Ignore the PFIC ENA pin value and turn OFF.

Address: hex decimal char
0x6E 110 n

Name: **Battle Short Mode Enable**

Description: Allows engaging Battle Short mode via serial interface (only applicable to MPFIC modules)

Natural Response units: hex

Read/Write: Read/Write

Discussion: value of 10 (0xA) allows Battle Short mode to follow BS Pin [default]
writing value of 11 (0xB) turns on Battle short mode regardless of BS Pin value

<u>Example Cmd:</u>	<u>Typical Response:</u>	<u>Interpretation:</u>
mn?↵	m'n= 0x000A↵	unit m is obeying BS pin
@n=11↵	none (response muted for global addr @)	Everyone: Battle Short Mode = On
mn=10↵	m'n= 10↵	unit m, obey BS pin again

Address: hex decimal char
0x63 99 c

Name: **AC Line Status**

Description: Status

Responses: bit 1 AC Line Voltage dropout
bit 2 AC Line Voltage brownout
bit 3 AC Line Voltage surge
bit 4 AC Line Frequency out of range
bit 5 Unit is in dropout recovery mode

Natural Response units: hex

Read/Write: Read Only

Discussion:

<u>Example Cmd:</u>	<u>Typical Response:</u>	<u>Interpretation:</u>
mC?↵	m'c= 0x0004↵	AC Line voltage is below brownout threshold

SynQor Single Phase Full-brick PFIC Terminal Commands

Address:	hex decimal char 0x67 103 g	
Name:	Self Test Status	
Description:	Self test status bits	
Responses:	bit 0 Reserved bit 1 Over Temperature bit 2 Bias supply out of range bit 3 Hold-up under-voltage bit 4 Hold-up over-voltage bit 5 Internal PLL unlocked bit 6 PFIC ENA set to OFF bit 7 Reserved bit 8 Internal PLL timeout bit 9 Reserved	
Natural Response units:	hex	
Read/Write:	Read Only	
Discussion:	Any bit set indicates an abnormal situation, but unit may continue to operate if able	
Example Cmd:	Typical Response:	Interpretation:
<u>mg?✓</u>	<u>m'g= 0x0020✓</u>	<u>PFIC ENA set to OFF</u>

Address:	hex decimal char 0x77 119 w	
Name:	BS Warnings	
Description:	Status bits associated with the BATTLE SHORT pin (warnings)	
Responses:	bit 0 Warn Over Temperature bit 1 Communication Override	
Natural Response units:	hex	
Read/Write:	Read Only	
Discussion:	These flags indicate the reason the BATTLE SHORT pin internal pull-down transistor has been turned off	
Example Cmd:	Typical Response:	Interpretation:
<u>mw?✓</u>	<u>m'w= 0x0002✓</u>	<u>Battle Short Warning is due to communication override</u>
