

Synergy Controller Software Programming for Sigma C4 Programmers

Synergy Controller Family



Sigma C4/C5 Controller



Introduction

Tidal Engineering's Synergy Controllers provide state-of-the-art usability and connectivity for environmental test control and data acquisition. They combine the functions of a chamber controller and a data logger and with their built in data loggers and E-Mail, FTP capabilities, these controllers can "Delivers Test Results" in virtually any application.

The Synergy Nano is popular for controlling test chambers, process ovens, and thermal platforms. This application describes Synergy Controller's command set and is intended to help test and instrumentation engineers port programs written for Sigma Systems C4/C5 programmers to the Synergy Controller family of programmers.

Visit www.tidaleng.com for a complete command set and technical manual for more information.

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1.0 Reset

1.1 Sigma Command: DC

This is what the command does (Per the Sigma C4 manual):

- Flush the communications input & ring buffers [TIDAL] N/A
- Flush the command buffer [TIDAL] N/A
- Clear the GT/RA command timeout flag
- Turn the refrigeration compressor port to its default state per setup parameter F6
- Turn the Aux/Power Port to its default state per setup parameter F5
- Clear the Aux input flag
- Clear the Component Fault input flag
- Clear the event bits in the Error Byte, Status Byte, and Error/Status string
- Setup the Serial Poll register. [TIDAL] N/A
- Reset the SRQ enable bit. [TIDAL] N/A
- Turn controller off (stop all heating and cooling, turn off blowers)
- Return the setpoint to 30°C
- Replaces any temporary setup parameters with the values from the permanent table

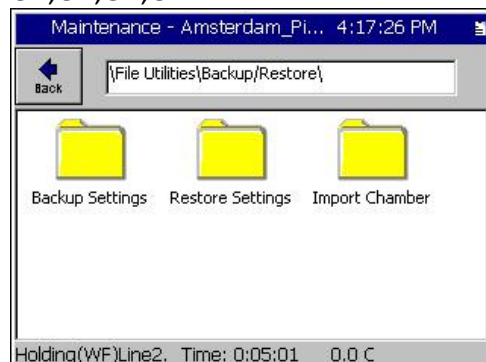
1.2 Synergy Command: = OFF; = SP1 30; = RESTORE POWER_ON_RESET.CFG

The Synergy Controller has more than 900 settings. The best way to initialize the controller to a specific startup condition is to capture the settings to a Startup settings file using the controller's Backup feature and then programmatically load this file as required; For Example capture the settings to the file "POWER_ON_RESET.CFG" and then execute "= OFF; = SP1 30; = RESTORE POWER_ON_RESET.CFG" to do the reset.

In this example, these commands will turn the chamber off, set the temperatures to ambient (or required default temperatures) and reset the other controller settings.

Synergy Controller Response

OK;OK;OK;OK



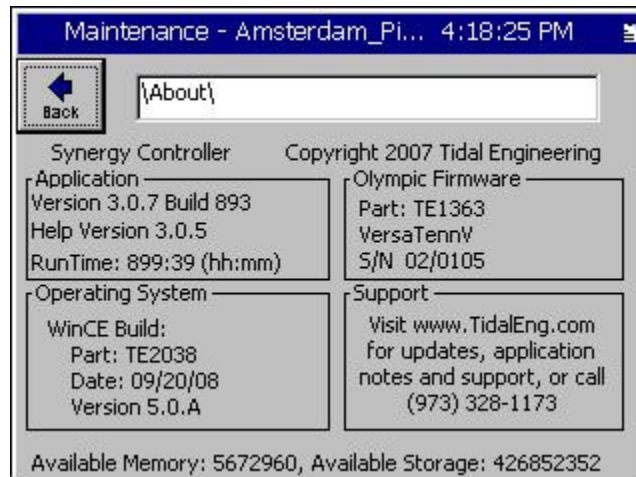
2.0 Firmware Query

2.1 Sigma Command: QN

2.2 Synergy Command: *IDN?

Query: *IDN?

Response: Tidal Engineering, Synergy Controller, Serial-02/0105, Version 3.0.7
Build 889



3.0 Revision Query

3.1 Sigma Command: QV

3.2 Synergy Command: *IDN?

Query: *IDN?

Response: Tidal Engineering, Synergy Controller, Serial-02/0105, Version 3.0.7

Build 889

4.0 Error Query

4.1 Sigma Command: QE

Monitors more than alarms - see section 7.8 of manual.

4.2 Synergy Command: ? ALM

? ALM

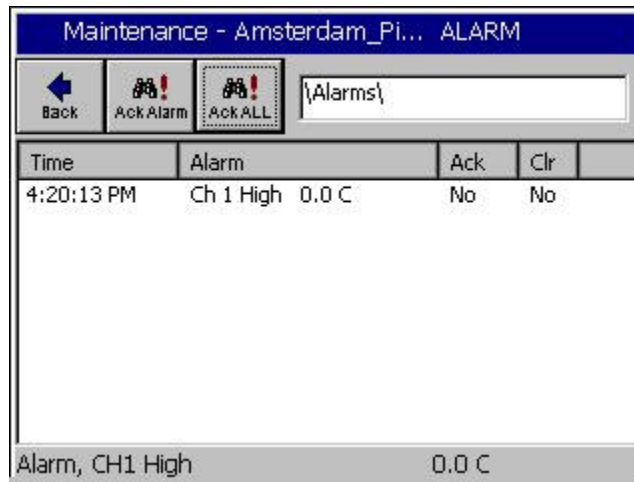
Synergy Response:

No Alarms, "0, 0, 00000000"

Over-temp alarm: "1, 1, 00000800" (Not Acknowledged, Not Cleared)

Over-temp alarm: "1, 0, 00000800" (Not Acknowledged, Cleared)

Comments: The Synergy Controller doesn't currently have a status byte.



5.0 Read temp

5.1 Sigma Command: PT%d

5.2 Synergy Command: . ? Cn

? Cn where n is channel

Example: ? C1

Response: 23.4

Comments: n can be 1 or 2 on two channel systems, and up to 4 on four channel systems. For the dual control system, ? **C1** returns channel 1 temperature and ? **C2** returns channel 2 temperature.

6.0 Blowers enabled / disabled

6.1 Sigma Command: BF or BO

6.2 Synergy Command: EVENTS .

= EVENTS 1 1 (Event 1 On)

= EVENTS 1 0 (Event 1 OFF)

? EVENTS 1 (Events Query)

Comments:

The C4's BF command will turn the blowers off in idle mode.

On the Synergy Controller, Event functions are defined by the hardware arrangement. Vendors can provide the specific EVENT number assignment for the Blower.



7.0 Set DUT temp range

7.1 Sigma Command: SL <low limit> <upper limit>]

The SL command sets the lower DUT limit (setup parameter F27) and the upper DUT limit (setup parameter F28).. The command sets the lower and upper temperature limits at the same time. The syntax of the command is:

SL III.l uuu.u<CR><LF>

where: III.l is the lower limit (F27)

uuu.u is the upper limit (F28)

III.l & uuu.u are one decimal place numbers

Example:

SL -75 130<CR><LF> Sets DUT limits to -75C & +130C

7.2 Synergy Command: .

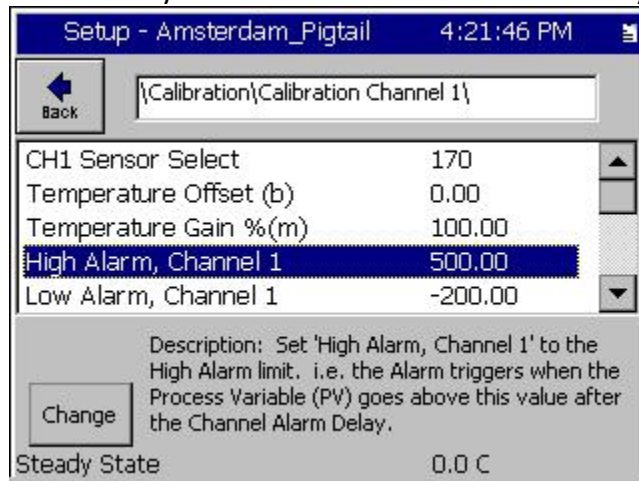
Alarm Limits

= AnL t and =AnH t Where n is channel number and t is High Limit or Low Limit.

Deviation Alarm Limits

= AnDL t and =AnDH t Where n is channel and t is High Deviation Limit or Low Deviation Limit.

Alternatively a User Alarm can be defined for any SensorID



8.0 Settling band (temp & stable time)

8.1 Sigma Command:

SB <settle_band> <stable_time>

If time is omitted it is assumed to be 0 – touch & go

The SB command sets the setpoint temperature bandwidth and minimum stable time requirements for satisfying a go to temperature request (setup parameters F31 & F32). The command sets the setpoint temperature bandwidth and stable time at the same time. The syntax of the command is:

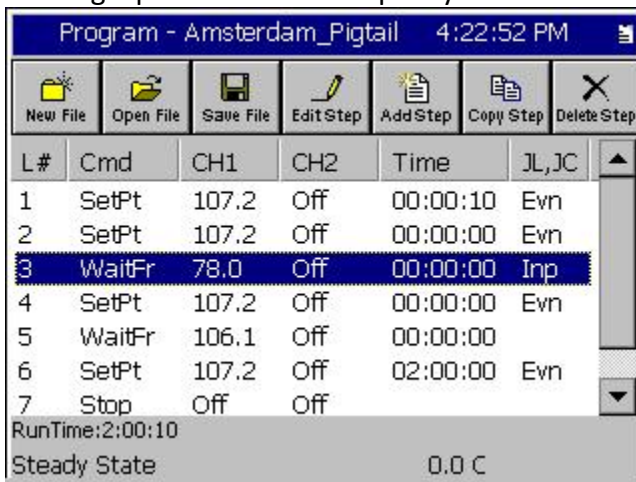
SB tt.t ss<CR><LF> Celsius mode where tt.t is degrees of temperature bandwidth (from setpoint) allowed to satisfy a go to temperature request). The valid range of this parameter is .1°C to 10°C. Default = 0.8°C

ss is seconds of stable temperature (within above bandwidth) required to satisfy a go to temperature request. The valid range is 0 to 59 seconds. Zero has the special meaning that the setpoint will be considered satisfied the first time the controlling probe temperature reaches or passes through the setpoint (the allowable bandwidth as above). Default = 15seconds. Example: SB .8 15<CR><LF>

Sets the settling band parameters to the °C mode default values of 0.8°C and 15 seconds

8.2 Synergy Command:

The Synergy Controller offers a Ramp Rate Limiting feature and a WaitFor step when running a profile which can specify a tolerance and time.



The screenshot shows a software window titled "Program - Amsterdam_Pigtail" with a timestamp of 4:22:52 PM. The window contains a toolbar with icons for "New File", "Open File", "Save File", "Edit Step", "Add Step", "Copy Step", and "Delete Step". Below the toolbar is a table with the following columns: L#, Cmd, CH1, CH2, Time, and JL,JC. The table contains 7 rows of data, with the third row highlighted in blue. At the bottom of the window, it displays "RunTime:2:00:10" and "Steady State 0.0 C".

L#	Cmd	CH1	CH2	Time	JL,JC
1	SetPt	107.2	Off	00:00:10	Evn
2	SetPt	107.2	Off	00:00:00	Evn
3	WaitFr	78.0	Off	00:00:00	Inp
4	SetPt	107.2	Off	00:00:00	Evn
5	WaitFr	106.1	Off	00:00:00	
6	SetPt	107.2	Off	02:00:00	Evn
7	Stop	Off	Off		

RunTime:2:00:10
Steady State 0.0 C

9.0 Select immediate

9.1 Sigma Command: SI

if SI is sent while the controller is in SP mode, all SP mode queued commands are discarded upon receipt of the SI command.

A bit more info on this command:

Remote Immediate (SI) and Remote Program (SP) Modes

The C4 can process commands either immediately upon receipt or in the sequence received.

In Remote Immediate Mode all operational commands (go to temperature, hold at temperature, etc.) and all setup commands are processed when received. Any previous command that was being processed is canceled and discarded. Query commands are also processed upon receipt, but do not cancel the underlying operational command that may be in process. This mode relies on the controlling computer to keep track of events and provide commands as needed on a real-time basis. This mode is selected by the SI command.

In Remote Program Mode (not related to the Program Mode that can be selected using the front panel mode switch), operational and setup commands are queued or stacked in a command buffer. Each command is executed to completion before the next command in the queue is retrieved and executed. Query commands are processed upon receipt and do not interrupt the processing of queued commands. This mode relies on the C4 to keep track of events. This mode is selected by the SP command.

SI (Immediate Mode) or the default SP (Program Mode) are typically issued at the beginning of a program sequence. However they may be issued at any point. If the C4 receives a SI command and there is a command executing and/or commands in the command buffer, the executing command is interrupted and the command buffer is cleared. In either SI or SP modes, each command is discarded after execution so there is no need to clear buffer space using resets or similar commands.

9.2 Synergy Command: .

The Synergy Controller runs all commands immediately. The Program (AKA Profile) mode is used to operate the controller with a program that specifies the temperature versus time.

10.0 Quit controlling

10.1 Sigma Command: QU

The QU command stops the C4 from controlling temperature. All heating and cooling is turned off, the blowers are set to the mode determined by setup parameter F15 (Blower Shut-off Mode). The refrigeration compressor port and the aux/power ports are not affected. The C4 can also be commanded to STOP controlling the temperature by issuing a DC command or IEEE-488 standard I/O statements ABORTIO, Device Clear, or Selected Device Clear. The primary functional difference is that the QU commands simply returns the system to the idle state. The DC command results in a system reset.

10.2 Synergy Command: = OFF

The command will turn off the all heating, cooling, blowers, etc.

11.0 Select active probe

11.1 Sigma Command: PN

PN<probe_num> CHANNEL SENSOR

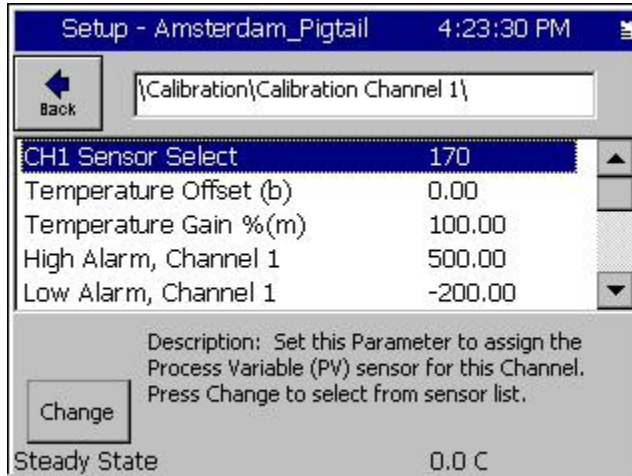
11.2 Synergy Command: CHnSENSOR

= CHnSENSOR x

Where n is Channel (1 or 2)

x is sensor ID (i.e. 110 for RTD 1, 120 for RTD2, etc)

Response: OK



12.0 Go to temp

12.1 Sigma Command: GT <setpoint_temp><min_ramp_rate> or GT <setpoint_temp>

Example: GT 125 5: Go to 125°C and set warning if ramp rate falls below 5°C/minute

OR

RA < setpoint_temp> <ramp_hr> <ramp_min> <ramp_rate> or

RA < setpoint_temp> <ramp_hr> <ramp_min>

Example: RA -55 2 15 1:

Ramps to -55°C over 2 hours and 15 minutes. Sets minimum ramp warning if unable to maintain at least 1°C/minute ramp rate. Set appropriate time delay

12.2 Synergy Command:

The Synergy Controller controls temperature ramp in the Ramp Rate mode in Steady State operation or in program mode.



= SPn t;= AnDL t ;= AnDH t ;= AnDT s

where n is channel, t is temp, s is seconds

AnDL Deviation Limit Low'

AnDH Deviation Limit High

AnDT Deviation Delay Time (seconds)

OK;OK;OK;OK

See Application Note 121 for Ramp Rate limiting mode.

Appendix A Troubleshooting

Note that the C4 and the Synergy Controller SP1 and SP2 commands share similar syntax but different functionality.

For example:

The Sigma Command SP1 30 switches control to Sensor 1 and sets the controller to 30 Degrees.

The Sigma Command SP2 30 switches control to Sensor 2 and sets the controller to 30 Degrees.

The Synergy Command SP1 30 sets channel 1 to 30 degrees, it has no effect on the sensor selection.

The Synergy Command SP2 30 sets channel 2 to 30 degrees, it has no effect on the sensor selection.

Since the Synergy Controller handles up to 4 channels, the commands SP3 and SP4 are also available for those configurations.

To switch the control sensor for the Synergy Controller

"= CH1SENSOR n" where n is the Sensor ID from the Tables below.

Sensor	Value	Description
RTD 1	110	Platinum 100 ohm RTD
RTD 2	120	Platinum 100 ohm RTD
Analog 1	130	0 to 5 Volt DC Signal
Analog 2	140	0 to 5 Volt DC Signal
Analog 3	150	0 to 5 Volt DC Signal
Analog 4	160	0 to 5 Volt DC Signal
T/C 1	170	Thermocouple 1
T/C 2	180	Thermocouple 2

	UUT 1	UUT 2	UUT 3	UUT 4	UUT 5	UUT 6	UUT 7	UUT 8
Sensor 1	211	221	231	241	251	261	271	281
Sensor 2	212	222	232	242	252	262	272	282
Sensor 3	213	223	233	243	253	263	273	283
Sensor 4	214	224	234	244	254	264	274	284
Sensor 5	215	225	235	245	255	265	275	285
Sensor 6	216	226	236	246	256	266	276	286
Sensor 7	217	227	237	247	257	267	277	287
Sensor 8	218	228	238	248	258	268	278	288

For example "= CH1SENSOR 110" switches control for Channel 1 to RTD 1.

For example "= CH2SENSOR 218" switches control for UUT Module 1, Sensor 8.

Appendix B Synergy Controller Application Notes

You can access our YouTube channel to see some of the unique features and benefits of our controllers here: <https://www.youtube.com/channel/UCxJF1O5aUDzcpdlCCoCKh6w>

The application notes on these topics can be accessed using the links below.

[AppNote 1 - Replacing a VersaTenn III Controller](#)
[AppNote 2 - Synergy Controller Data Logging Capacity Calculations](#)
[AppNote 3 - Retrofitting a Qualmark HALT/HASS Chamber :](#)
[AppNote 4 - Configuring the Synergy Controller to Read from a Bar Code scanner :](#)
[AppNote 5 - Synergy Controller vs. VersaTenn III :](#)
[AppNote 7 - Synergy Controller WebTouch Remote Feature](#)
[AppNote 8 - Using SimpleComm application to communicate with the Synergy Controller](#)
[AppNote 10 - Synergy Controller Retransmit Signal Conditioner :](#)
[AppNote 20 - Using the TE1908 Single Channel Thermocouple Signal Conditioner.](#)
[AppNote 25 - Using the Synergy Controller with Space Chamber applications.](#)
[AppNote 26 - Using the programmable User Alarms with the Synergy Controller.](#)
[AppNote 40 - Two Point Calibration.](#)
[AppNote 45 - Using the Synergy Controller's ftp server.](#)
[AppNote 49 - Synergy Controller Security Enhancements.](#)
[AppNote 56 - Using the Synergy Controller Watchdog Timers.](#)
[AppNote 58 - Synergy Controller Wet-Bulb/Dry-Bulb Humidity Measurements.](#)
[AppNote 59 - Synergy Controller Wireless Network Setup.](#)
[AppNote 60 - Graphing Synergy Log Files in Microsoft Excel.](#)
[AppNote 67 - Synergy Controller Mounting Options.](#)
[AppNote 71 - Synergy Controller PWM Retransmit Feature](#)
[AppNote 72 - Synergy Controller Thermocouple Data Acquisition with Synergy UUT Modules](#)
[AppNote 74 - Synergy Controller LED Backlight Retrofit Kit](#)
[AppNote 77 - Synergy Controller Remote Start/Stop Feature](#)
[AppNote 84 - Synergy Controller E-Mail Feature](#)
[AppNote 85 - Synergy Controller Logging Features and Applications](#)
[AppNote 89 - Synergy Controller Loop-Back Setup](#)
[AppNote 90 - Synergy Controller Network Printing Feature](#)
[AppNote 91 - Synergy Controller Built-In Alarms](#)
[AppNote 95 - Synergy Controller Kft and other Pressure Display](#)
[AppNote 96 - Synergy Controller Analog Retransmit Applications](#)
[AppNote 99 - Synergy Server Feature](#)
[AppNote 102 - Synergy Certified OEM and Installer Training](#)
[AppNote 106 - Synergy Controller Cascade Loop \(Part Temperature\) Control Feature](#)
[AppNote 107 - Synergy Controller Programming with Python](#)
[AppNote 109 - Synergy488 Kit Setup for Synergy Nano and Synergy Quattro GPIB](#)
[AppNote 112 - General Purpose Logic Programming for OEMS and Integrators](#)
[AppNote 113 - Main Screen Display Setup Options](#)
[AppNote 116 - Synergy Controller Pressure Applications](#)
[AppNote 117 - Synergy Controller Help System Video QR Codes.](#)
[AppNote 121- Synergy_Controller_Ramp_Rate_Control](#)

About the Synergy Controller Family

Tidal Engineering's Synergy Controllers, including the Synergy Micro 2, Synergy Quattro, and the ¼ DIN Synergy Nano provide state-of-the-art usability and connectivity for environmental test control and data acquisition and combine the functions of a chamber controller and a data logger. They are designed to improve test efficiency by supporting both factory automation and test and measurement protocols and standards.

Synergy Controller feature highlights includes:

- ➔ Color touch screen
- ➔ Ethernet, RS-232 and GPIB communications
- ➔ Built in 100 MB Data logger with USB drive support
- ➔ Data Acquisition, up to 64 T-type thermocouples (Optional)
- ➔ Built-in Web Server for remote control; WebTouch Remote™
- ➔ Compatible with Synergy Manager for PC based control, monitoring and programming.
- ➔ Built-in FTP Server for factory automation and test and measurement applications

For more information regarding these controllers please see the full Synergy Controller Technical Manual on our website at <http://www.tidaleng.com/synergy.htm>

About Tidal Engineering

Headquartered in Randolph, NJ, Tidal Engineering Corporation has been designing and building award-winning embedded hardware and software for test and measurement and data acquisition applications since 1992. The company is recognized for technical expertise in such areas as Embedded IEEE 488, and turnkey SCADA (Supervisory Control and Data Acquisition) systems.

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