### **Synergy Controller Maintenance Timers and Counters**



#### Introduction

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. They combine the functionality of a chamber controller and a data logger and are designed to improve test efficiency by supporting both factory automation and test and measurement protocols and standards. With the flexibility afforded by their multiple communication ports; Ethernet , GPIB/IEEE 488, and RS-232, these controllers are perfect for today's dynamic testing environments.

The Synergy Controller Maintenance Timers and Counters (MTC) features were developed for organizations using predictive maintenance to reduce downtown and save maintenance costs.

With these MTC features, the Synergy Controller calculates the cycle counts and runtime for every output and uses these calculations to generate alarms and warnings when component life limitations of chamber components are known. This application describes these MTC features.

Information and features concerning Maintenance Counter and Timer Data Persistence, Protection and Redundancy is included in Appendix A. February 2019, Revision Preliminary

#### **Maintenance Timers and Counters**

These Timers and Counters extend the functionality of the RunTime Meter feature first available in Synergy Controller version 2.x.x. They are designed to monitor the two principle wear-out mechanisms in mechanical systems, run-time and cycle count, and are used both to measure component lifetime and to schedule preventative maintenance to avoid unscheduled down-time.

Maintenance - LV1	ALARM
About\	
Synergy Controller Cop	yright 2013 Tidal Engineering
Application	Olympic Firmware
Version 4.1.10 Build 1038	Part: TE1363
Help Version 4.1.10	VersaTennV
RunTime: 1972:21 (hh:mm)	S/N 02/0105
Operating System	Support
WinCE Build:	Visit www.TidalEng.com
Part: TE2144	for updates, application
Date: 9/17/2015	notes and support, or call
Version 5.0.F	(973) 328-1173

These features are access from the Maintenance Screen by clicking on the Maintenance Counters icon.



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The operational time and cycle count variables are displayed at the bottom of the screen for the selected Output. Clicking on any output will show that output's counters (including Virtual Outputs).

Maintenance - MaintTestPro 5:13:54 PM 📲					
Back Edit Alrr	n Reset All	\Counters\	Previous	Next	
Solar	Heat	Humid Fill	• Fron	it Solar	
DEFROST	🔍 Humid	\varTheta DOOR	🔍 Тор	Solar	
Comp En.	BLWR RS	ST 🔍 AHU1 XV 👘	🔍 Rear	r Solar	
SUCT.	BLWR EN	N 🔍 AHU2 XV 👘	Heat	:	
ECON	VEL SIM	AHU1 EPR	Hum	idify	
CR1	VEL SIM	EN 😐 AHU2 EPR 🛛	O DH E	PR	
CR2	🔍 ним 👘	HG VLV	😐 AlmF	dy1	
DH Fan	🔍 HI LIGHT	TS 😐 DH XV POS	😐 AlmF	ly2	
Selected Output 1: .Logic1, 0.0 Hours, 0 Cycles					
Chamber Off		-5.0	IC 0	.0 %	

To reset an Output's time and cycle counter, select the Output and press the **Edit Alrm** button. From this screen, Maintenance counters and timers and their Alarms can be set and cleared.

Maintenance - MaintTestPro 5:25:1	.8 PM 📲
Hack Reset Counters\Output 1	
Cycle Count 0 Run Timer (h) 0.0	
Maintenance Alarms	
Warn on High Cycles	
Warn on High Timer	
Chamber Off -5.0 C	0.0 %

The controller will prompt the user for confirmation after the **Reset** button is pressed.

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To reset ALL counters and timers in the system, click the **Reset All** button. The controller will prompt the user for confirmation after the **Reset All** button is pressed.

#### Algorithms

For On-Off outputs, the Cycle Count increases for each transition from On to Off. The Timer increases each second the output is on.

For PWM outputs, the Cycle count is incremented:

- once each period when the output is > 0% and < 100%.
- when the output is turned off.
- or after one or more full 100% on cycles output drops below 100%.

For PWM outputs, time is accumulated based on sum of the output percentages taken each second of the Output's period.

When reset button is pressed or the reset command is received, the cycle count value and runtime hours counters are both reset back to zero.

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#### **Creating Alarms with MTC**

The Synergy Controller calculates MTC data for every output. There are two ways to create alarms for specific outputs to help with preventative maintenance , for example for cryogenic valves and compressors.: 1) Maintenance Counters can be setup from the Mantenance Counter screen, or 2) users can select Maintenance Counters in the User Alarm System SETUP\User Alarms.

#### **Creating Alarms from the Maintenance Countes Screen**

Access the Maintenance Counters from the Maintenance Screen by clicking on the Maintenance Counters icon. Creating or modifying Maintenance Counter alarms through the Maintenance Counter screen will create, modify and delete custom User Alarms. It is a simplified method of creating the alarms described in the next section.



#### Select an output and then click on the Edit Alrm button.

Maintenance - MaintTestPro 5:13:54 PM 📲					
Back Edit Alm	m All	Counters\	Previous	Next	
• Solar	• Heat	• Humid Fill	• Fron	t Solar	
DEFROST	🔍 Humid	DOOR	🔍 Тор	Solar	
Comp En.	BLWR RST	AHU1 XV	🔍 Rear	r Solar	
SUCT.	BLWR EN	AHU2 XV	🔍 Heat	:	
ECON	VEL SIM	AHU1 EPR	🔍 Hum	idify	
CR1	VEL SIM EN	O AHU2 EPR	😐 DH E	PR	
CR2	🔍 НИМ	HG VLV	😐 AlmF	dy1	
DH Fan	HI LIGHTS	O DH XV POS	😐 AlmF	ly2	
Selected Output 1: .Logic1, 0.0 Hours, 0 Cycles					
Chamber Off		-5.0	DC O	.0 %	

Use this screen to reset the any output's counters and timers, view the current counters, and view and modify Maintenance Counter Alarms.

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Maintenance - MaintTestPro 5:25:18 PM	ä
Image: specific constraints         Counters         Output 1	
Cycle Count 0 Run Timer (h) 0.0	
Maintenance Alarms	
Warn on High Cycles	
Warn on High Timer	
Chamber Off -5.0 C 0.0 %	

To enable a Maintenance Counter alarm, click on "Warn on High Cycles" to alarm on high cycle counts, or "Warn on High Timer" to alarm on high runtime. After selecting these options, click on the text boxes to the right and enter the alarm threshold (hours or cycles). The screenshot below shows a cycle warning at 100,000 cycles, and a runtime warning or 4320 hours (180 days of runtime).

Maintenance - MaintTestPro 5:51:07 PM	ă
Back Reset Counters\Output 1	]
Cycle Count 0 Run Timer (h) 0.0	
Maintenance Alarms	
Warn on High Cycles 100000	
Warn on High Timer 4320.0	
Chamber Off -5.0 C 0.0 %	6

Unchecking one of the Maintenance Alarms will remove the alarm. Modifying the alarm value will update the alarm. Any changes will be saved when you cick on the **Back** buton.

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Press Yes to save the changes. Press No to discard the Changes. Press Cancel to return to the screen and continue to make changes.

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#### **Creating Alarms for Maintenance Counters using User Alarms**

On the Setup screen, click on User Alarms



#### In the User Alarm screen, click on Add Alarm.

Setup - 4Chan Test			5	:58:14	F PM	ä	
e Back	Add Airm	 Edit Alrm	X Delete Airm	СоруАІгт			
SenID	Alarm	Na	Rpt L	.og F	Rly	Ack	
Steady 9	State			24	4.4 C	Off inv	NC

#### Click in the Sensor field to bring up the Sensor Select screen

Add Alarm Wi	zard - 4Chan T	5:59:06 PM 🔰 🚆
	Click in the box be the sensor on whi	low to select ch to alarm.
	Sensor	
SYNERGY	<- Back Next -	> <u>C</u> ancel

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At the bottom of the Module list, are entries Out Cycles and Out Hours. These stand for Output Cycles and Output Hours. Selecting either of those items will display a list of all outputs in the system.

Add Alarm Wizard - 4Chan T	5:59:48 PM 🔰 🚆
Module	
Watchdog  Outputs Outputs Out Cycles Out Hours	
Accept	ncel

Select the desired output to create a warning alarm for, and click the 'Accept' button.

Add Alarm Wiz	ard - 4Chan T 6:01:13 PM	ä
Module	Outputs	
Watchdog  Outputs Outputs Outputs Out Cycles Out Hours	Output 1Fan Output 2-BUZR 1 Output 3PIDH Output 4-BUZR 2	
Acce	pt Cancel	

Click 'Next' to continue with the setup.

Add Alarm Wiza	ard - 4Chan T	6:03:19 PM 🛛 📓
	Click in the box b the sensor on wh	elow to select ich to alarm.
	Sensor	2601
SYNERGY	<- <u>B</u> ack <u>N</u> ext	-> <u>C</u> ancel

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For the comparison, select 'Greater Then' and for Data Scaling, select 'Raw Value'. Click 'Next'.

Add Alarm Wiz	zard - 4Chan T 6	6:04:53 PM	Ē
	Click in the boxes be comparison type and	low to select the d data scaling.	
	Comparison: (Sens	or vs. Threshold)	)
	Data Scaling:		
	Raw Value	•	
SYNERGY	<- <u>B</u> ack <u>N</u> ext ->	⊆ancel	

Enter the alarm threshold (such as 10,000 cycles as shown)

Add Alarm Wi	zard - 4Chan T	6:07:37 PM	5
	Click in the box belo the alarm threshold	ow to enter I.	
	Alarm Threshold:	10000	
SYNERGY	<- <u>B</u> ack <u>N</u> ext -	·> <u>C</u> ancel	

Enter an alarm string



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Select Alarm actions.	For a warning.	be sure to not	check '[	Disable Chamber'
Sciecci / dairin actions.		be build to not	CHICCK E	

Add Alarm Wizard - 4Chan T	6:09:42 PM 🛛 🚆
Click the actions below that yo when the alarm is triggered.	u want to occur
🔽 Show Alarm	C Activate Relay 1
🔽 Log Alarm	
Disable Chamber	Relay 2
0	Alarm Delay (Sec)
-	
SYNERGY <- Back Net	xt -> <u>C</u> ancel

Click Next, and then click Finish. The alarm is now created and will warn once the Output reaches 10,000 cycles.

#### Appendix A MTC Data Persistence, Protection and Redundancy

MTC data (cycle counts and runtime hours) are stored in a primary and backup file on the Synergy Controller. The primary file is \Storage Card\running.dat. The backup file is \FlashDisk\running.dat. The MTC values are written to disk every 30 minutes.

At startup, the file with the newest timestamp (defaulting to the version on the Storage Card if the timestamps are identical) is loaded first. If there is an error loading or reading the primary file, a dialog prompts the userr to either load data from the backup or older copy, or to reset the maintenance counters to zero. If the file don't exist or can't be read, the maintenance counters are reset and a message indicating that "The MTC values have been reset".

#### Importing and Exporting MTC Data

To import or export MTC data (when creating a backup, loading exported maintenance counter data onto a new controller after a hardware change, etc.), users can access the Backup and Restore functions under File Utilities on the Maintenance Screen.

Browse to Maint\File Utilities\Backup/Restore' for the Backup and Restore options.



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The controler will prompt for a save location the backup file. Select an appropriate location to backup the maintenance counters to (such as a USB drive).

Maint	enance Screen	1:12:4	3 PM 🛛 📓
e Back	File Utilities\Backup/F	Restore\Backup\Se	ttings\
Backup M	Maintenance Counters		
\Storage Card\vpl\maintbackup.mc Browse			
	Backup	Cancel	
Steady S	itate	25.0 C	51.3 %

Select the backup location and Press the 'Backup' button to backup the maintenance counters. Once the backup is complete, a message will confirm the success of the backup. Store the backed up maintenance counters in a safe location.

Maintenar	nce Screen	1:16:	21 PM	ä
Hile Utilities\Backup/Restore\Backup\Settings\				
Backup Main	Synergy Cont	roller OK 🗙		
\Storage Ca	Successfully ba maintenance o \Storage Card\vpl\maint	icked up ounters to backup.mc	owse	
	Backup	Cancel		
Steady State	!	25.0 C	51.3 %	6

#### Importing MTC Data

To import (or restore) MTC data, from the 'Backup/Restore' screen under the Maintenance Screen, click on Restore.

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Select 'Restore Maintenance Counters' and press the 'Restore' button.

Main	tenance Screen	1:18:0	6 PM 🔰 🚆	
eack	Image: Back         Image: Second			
	Choose Action			
	Restore Maintenance Counters 💌			
Select this option to Restore all of the controller's Maintenance Counters.				
	Restore	ancel		
Steady (	State	25.0 C	51.3 %	

Select the retore file and then press the 'Restore' button.



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A prompt will appear requiring the user to confirm they would like to restore the selected maintenace counters. If the manitenance counters were exported from a different controller serial number, the user will be warned of that as well. Click **Yes** to restore, or click **No** to cancel the operation.



A confirmation window will be displayed to confirm the loading of the maintenance counters from the selected file.

Maintenan	ce Screen	1:24:3	86 PM 🛛 🛔
Restore Mair	le Utilities\Backup/I	Restore\Restore\S	Settings\
\Storage Ca	Successfully res maintenance co	tored ounters.	owse
	Restore	Cancel	
Steady State		25.0 C	51.3 %

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#### About the Synergy Controller Family

Tidal Engineering's Synergy Controllers, both 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. These controllers 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 <u>http://www.tidaleng.com/synergy.htm</u>

#### About Tidal Engineering

Headquartered in Randolph, NJ, Tidal Engineering Corporation has been designing and building awardwinning 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.

> Tidal Engineering Corporation Randolph, NJ 07869 Tel: 973-328-1173 www.TidalEng.com info@tidaleng.com



