ECONET EC+ / EC++ Multiple Actuation

Application Note 023

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Introduction

With this document we will explain Turbo cleaning valve activation principles and technologies designed to meet customer requirements and cover all application opportunities in industrial automation.
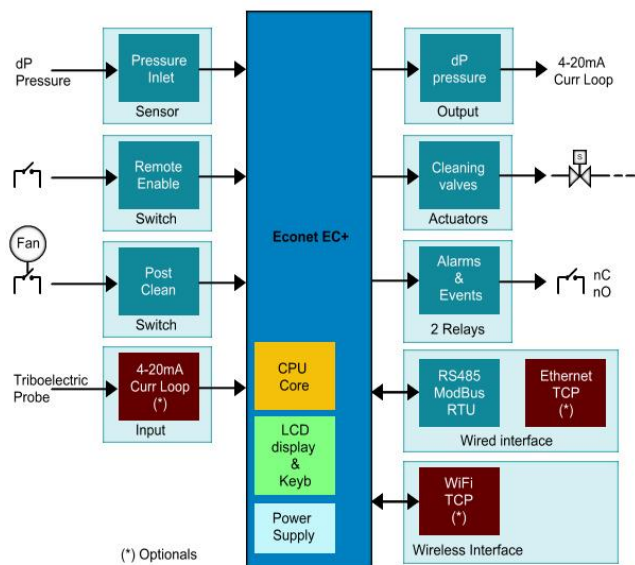
ECONET family basics

Briefly, the "Econet family" is made up of a series of Economizer models built for controlling pneumatic cleaning functions of industrial dust collection systems.

Brief, the differential pressure on the cleaning system is digitally controller by "Econet" on-board pressure transducer, allowing to determine filter obstruction with accuracy. Thanks to a smart technology, the Econet are able to handle the activation of the cleaning valves autonomously, only when it is needed, in order to save (economize) the entire system functioning.
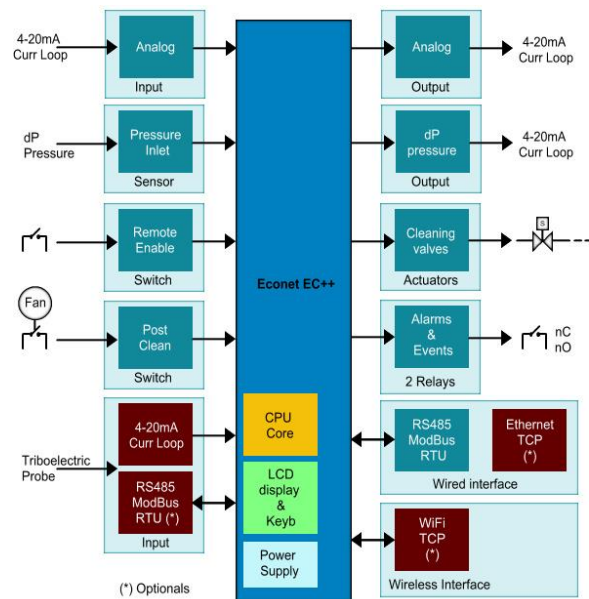
The Econet devices are provided of LCD graphical display for local programming and a lot of interfaces for system interfacing.

The Econet EC+ and EC++ schematic resources diagrams are shown below:

Econet EC+ version

Econet EC++ version

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Multiple Actuation concepts

All Turbo sequencers and economizers are designed to be used in cleaning machines in order to perform smart cleaning cycles for a wide range of industrial applications.

The developers have worked around single actuation basic concept, where the device drives one actuator (valve) a time , during a cleaning cycle, following a right sequence. Devices are provided of a single output for each cleaning valve, in the hardware.

Thanks to the Econet System Bus and a different hardware/firmware approach, in the Econet family devices, designers have expanded this concept to a "multiple actuation" task.

Following market requirements, the developers have traced a well-define road map to help end-users to perform multiple actuation performances.

No other hardware requirements are needed to invoke multiple valve actuation. All the configuring and driving functions are already available in the Econet device's firmware.

So, the end user can choice between single or multiple actuation mode in the easy way.

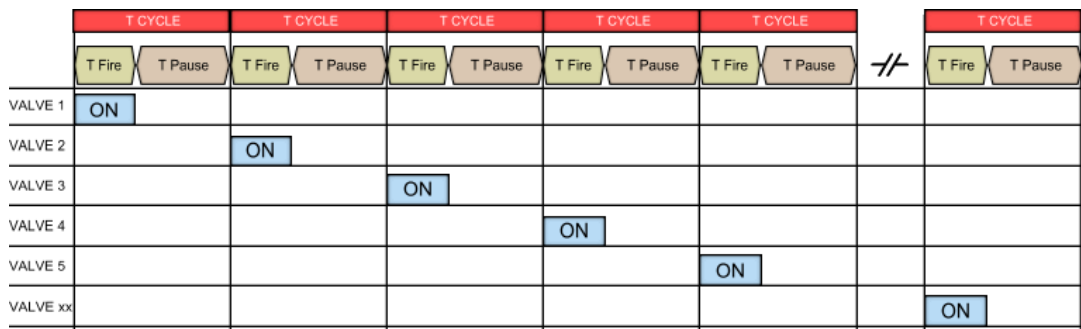In single actuation mode, the cleaning cycle follows the below timing diagram:

Figure 1

In multiple actuation mode, the cleaning cycle is performed in a similar mode but each valve is replaced by a valves group. An actuator container made of a set of 127 groups was built at the scope. Each group can contain up to 6 actuators (valves), which must be activated simultaneously. The device will perform the cycle sequentially, starting from group 1 up to the last group programmed, and then repeat the sequence from the beginning. The cleaning cycle follows the below timing diagram:

Figure 2

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Really, the multiple valve actuation is not technically possible because the total power to be used exceeds the device's power supply. Thus, between a valve and the other belonging to the same group, a configurable delay time has been introduced for this purpose.

The below diagram shows typical expanded timings for each group (i.e. group 1) of multiple actuation:
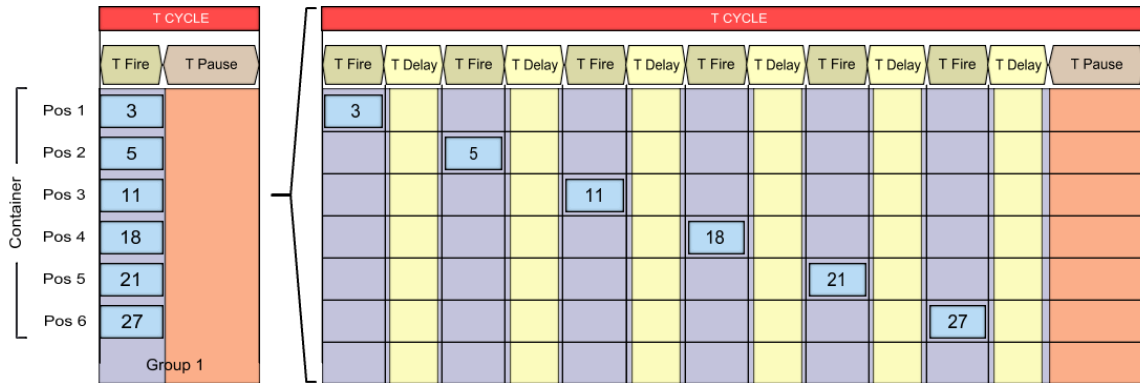

Figure 3

In the diagram, a delay time (T Delay) was automatically added between two firing times, in order to avoid simultaneous current overload during valve activation. With this the EC+ / EC++ can simulates a real multiple actuation without weighing on the main power-supply.

Thanks to the flexibility of this mechanism, it is possible to run cycles with different valve programming.
The user can fill all positions of the group or leave blank some of them, or repeat valve driving in different groups.

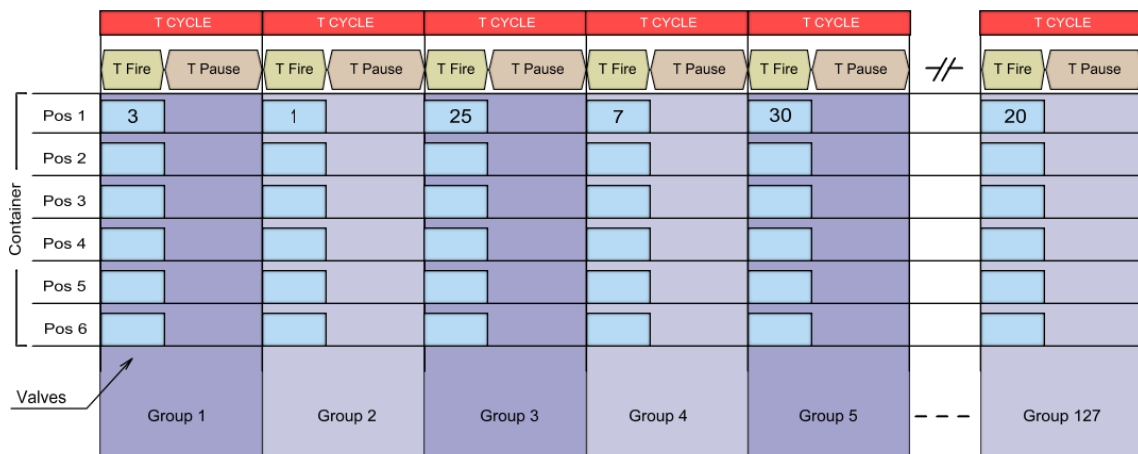*EXAMPLE 1: single non-sequential valve activation*

Figure 4

The example shows how to configure the EC+/EC++ in order to act a single activation of valves placed in different positions respect to the normal sequence.

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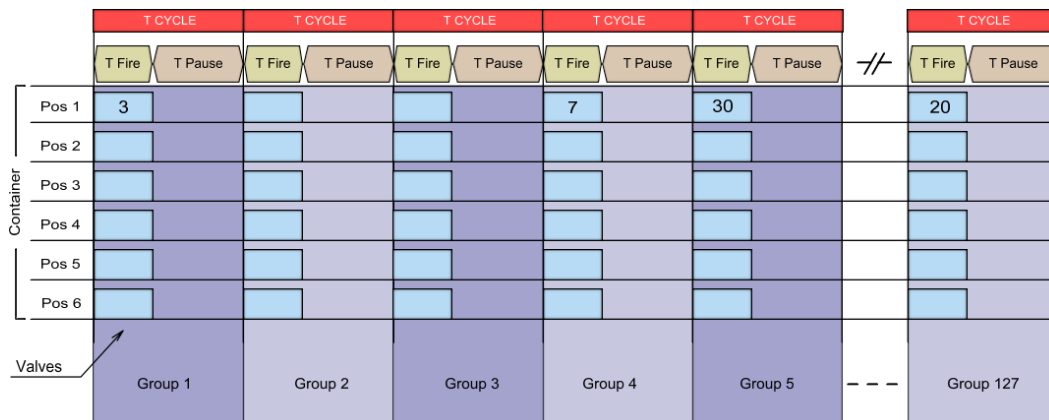*EXAMPLE 2: single non-sequential valve activation with pauses*

Figure 5

The example shows how to configure the EC+/EC++ in order to act a single activation of valves placed in different positions respect to the normal sequence, using also empty groups to increment pauses.

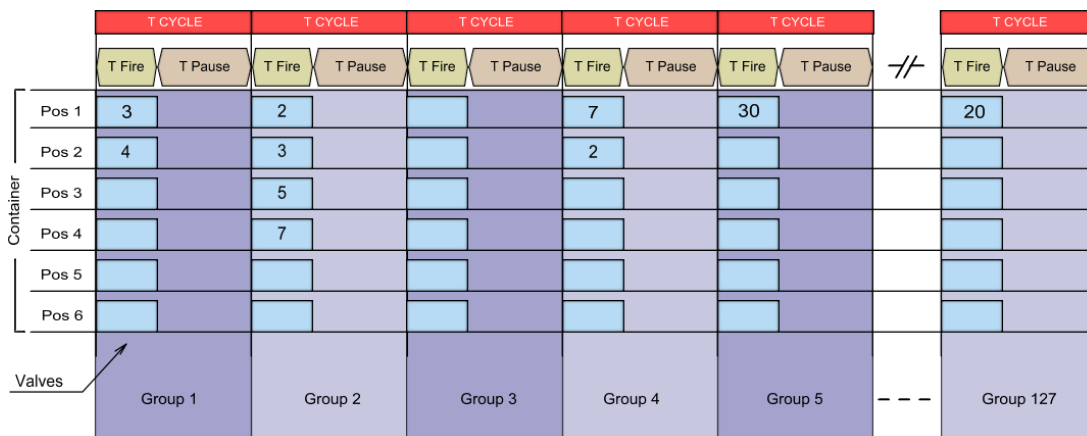*EXAMPLE 3: Multiple valve activation by repeating same firings of the valve several times*

Figure 6

The example shows how to configure the EC+/EC++ in order to act a multiple activation of valves placed in different positions respect to the normal sequence, and repeat several times the firing of the same valves in different groups (i.e. valve 3, valve 2, valve 7).

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Actuator Bus Wirings & cabling

The multiple actuation function can be applied to a wide range of cleaning system design configurations.
Thanks to the Econet Bus communication system, it is possible to connect together single valves on tanks and multi-valves in ERCP devices.
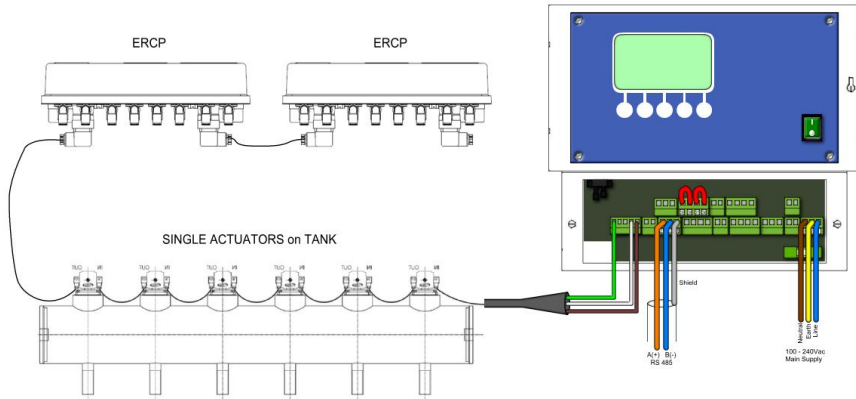
Figure 7

The Econet EC+ and EC++ have a RS485 ModBus serial port placed on the terminal block headers and accessible from the lower side of the device.
More information about interfacing are available into the "*Industrial Communication Application Note*" document of Turbo.
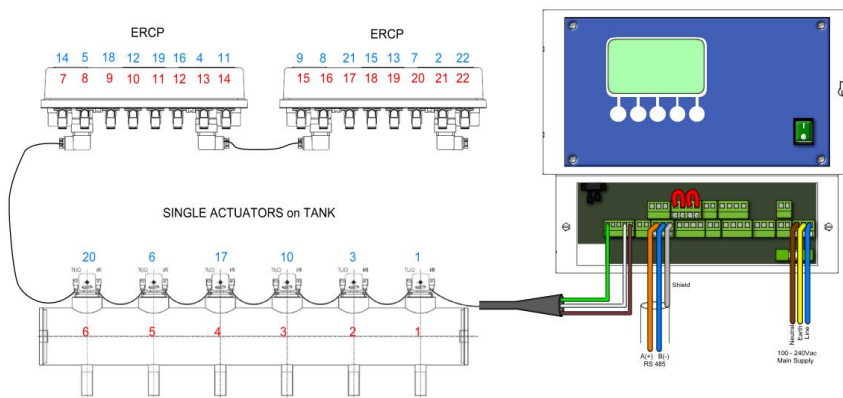
Figure 8

During the design of the system, the user must establish the activation sequence of the valves and create groups based on own system needs.
Then, the sequence must be inserted into the registers of the device, so that during the cleaning cycle it will execute what is established.

The above example shows in red color the hardware sequence of valves, as they will drive in single actuation mode. In blue color the user sequence. In the multiple actuation, the user must set groups registers with the numbers of actuators respect to its sequence.

Figure 9

Here is the programmed sequence saved into the multiple actuation registers. In red color are highlighted the valves associate to the groups established by the user, that are show in blue color.

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Enable Multiple Actuation

After cabling, the Econet EC+/EC++ are ready to work in single or multiple actuation mode.
A ModBus communication system is needed to configure and enable multiple actuation mode.
Once the user have configured multiple actuation registers by ModBus , he will able to enable or disable the function also using the local user interface placed on the EC+/EC++ devices.
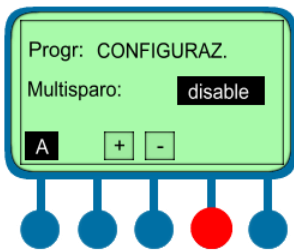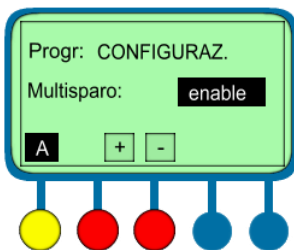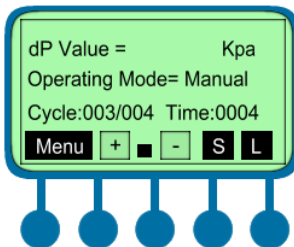
Figure 10

In order to enable the multiple actuation function, these steps must be followed:
- Power OFF the EC+/EC++ device;
- Press and maintain pressed the key red highlighted;
- Power ON the EC+/EC++ device during key pressing;
- After start-up, the device will enter in CONFIG menu.

Figure 11

- Press "+" or "-" keys to enable or disable the function;
- Press "A" key (yellow highlighted) to save the setting.

Now, the EC+/EC++ device will be able to perform the multiple actuation if the user have enable the function or come back to single actuation if he has disabled that.

Figure 12

When the user have enable multiple actuation function, on the EC+/EC++ LCD display will appears a "black square" between "+" and "-" keys.

Unlike single actuation mode, when the multiple actuation is enabled, the cycle value must be intended as:

Cycle: Currently actuator group / Total groups

The multiple actuation settings must be done via Modbus, following the information explained in the APNt021 "Industrial Communication Application Note" document of Turbo.
The main register are listed below; they are useful in order to set the actuation Type, the Delay time and to enable the function to operate.

Multiple actuator Enabling				
Item	*Register*	*Access*	*Default*	*Note*
Enable multiple actuation function	0x000D	R/W	0	0=Disabled 1=Enabled
Actuation type	0x0068	R/W	0	0=Single actuations 4295=Multiple actuations (*)
Multiple actuators Delay time	0x0069	R/W	100	100 ÷ 1000 msec

(*) *check firmware compatibility*

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Multiple Actuators programming

The complete list of ModBus registers related to multiple actuation function is shown below:

Multiple actuation Groups				
Item	*Register*	*Access*	*Default*	*Note*
Group 1 – Actuator 1	0x0070	R/W	0	1 ÷ 127
Group 1 – Actuator 2	0x0071	R/W	0	1 ÷ 127
Group 1 – Actuator 3	0x0072	R/W	0	1 ÷ 127
Group 1 – Actuator 4	0x0073	R/W	0	1 ÷ 127
Group 1 – Actuator 5	0x0074	R/W	0	1 ÷ 127
Group 1 – Actuator 6	0x0075	R/W	0	1 ÷ 127
Group 2 – Actuator 1	0x0078	R/W	0	1 ÷ 127
Group 2 – Actuator 2	0x0079	R/W	0	1 ÷ 127
Group 2 – Actuator 3	0x007A	R/W	0	1 ÷ 127
Group 2 – Actuator 4	0x007B	R/W	0	1 ÷ 127
Group 2 – Actuator 5	0x007C	R/W	0	1 ÷ 127
Group 2 – Actuator 6	0X007D	R/W	0	1 ÷ 127
Group 3 – Actuator 1...	0x0080	R/W	0	1 ÷ 127
Group 3 – Actuator ..6	0x0085	R/W	0	1 ÷ 127
Group 4 – Actuator 1...	0x0088	R/W	0	1 ÷ 127
Group 4 – Actuator ..6	0x008D	R/W	0	1 ÷ 127
Group 5 – Actuator 1...	0x0090	R/W	0	1 ÷ 127
Group 5 – Actuator ..6	0x0095	R/W	0	1 ÷ 127
Group 6 – Actuator 1...	0x0098	R/W	0	1 ÷ 127
Group 6 – Actuator ..6	0x009D	R/W	0	1 ÷ 127
Group 7 – Actuator 1...	0x00A0	R/W	0	1 ÷ 127
Group 7 – Actuator ..6	0x00A5	R/W	0	1 ÷ 127
......				
Group 126 – Actuator 1...	0x0458	R/W	0	1 ÷ 127
Group 126 – Actuator ..6	0x045D	R/W	0	1 ÷ 127
Group 127 – Actuator 1...	0x0460	R/W	0	1 ÷ 127
Group 127 – Actuator ..6	0x0465	R/W	0	1 ÷ 127

Multiple actuation Group content				
Item	*Register*	*Access*	*Default*	*Note*
Actuator pos 1 of currently active group	0x0470	R		
Actuator pos 2 of currently active group	0x0471	R		
Actuator pos 3 of currently active group	0x0472	R		
Actuator pos 4 of currently active group	0x0473	R		
Actuator pos 5 of currently active group	0x0474	R		
Actuator pos 6 of currently active group	0x0475	R		

Turbo has designed a PC software, named "PC-Panel" for remote management of the Econet devices functionalities. The software is already provided of a dedicated programming folder to help the user to configure all the multiple actuation registers.

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Appendix A – Revision History

Version draft	First draft	Dec 2017
Version 1.0	First Release	Jan 30th, 2018
Version 1.1	Updated Turbo HQ address	Nov 3th, 2021

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