TM
TUЯBO

E1T, E2T, E5T, E6T
Operating Modes

Application Note 030

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1

Summary

Operating modes

The operating modes of the E1T, E2T, E5T and E6T Control Units are shown below.

Manual

In "Manual" operating mode, the control unit will work as a programmable cyclic sequencer.

The solenoids connected at the control unit will be activated sequentially in order to perform a cleaning cycle, with the timing values configured in the related parameters. Here below the diagram of "Manual" operating mode:
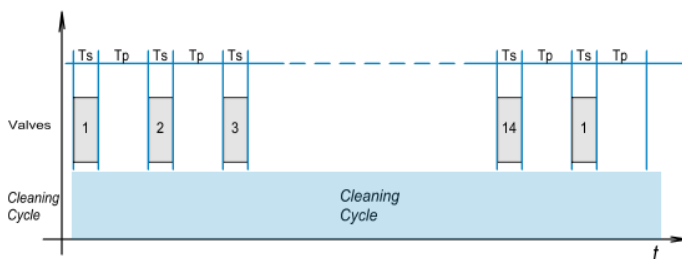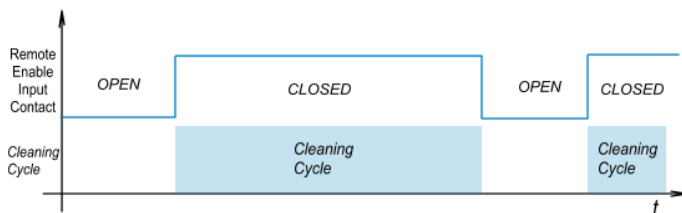

Ts = Pulse Time

Tp = Pause Time

n = pulsing solenoid

Tc = Tcycle = $[(Ts+Tp) \times n]$

(In this example the number of solenoids is set to 14 EV)

At the end of the last solenoid's activation, the cycle will continue, starting again from the first solenoid.

Effect of the "Remote Enable" input contact

A cleaning cycle will be performed only if the Remote Enable input contact (terminals 14-15) is closed.
If, during a cleaning cycle, the contact goes open, it will stop all activities until the contact will go close again. Then, the cleaning cycle will restart from the solenoid immediately after the last pulsed solenoid.

Effect of the "FAN OFF" input contact

If "FAN OFF" input contact (terminals 12-13) is open at power-on, the control unit will wait the contact to be closed in order to start a cleaning cycle.
If during a cleaning cycle the normally closed "FAN OFF" input contact (terminals 12-13) opens, the cleaning will be stopped at the end of the last solenoid pulsed and a post-cleaning (PCC) function will be performed, if configured to work. At the end of PCC, the control unit will wait the contact to be closed in order to start a new cleaning cycle. Please see "Post Cleaning" paragraph for more information.

Displayed information

During a cleaning cycle, the display of the control unit shows the cleaning progress with some useful information, like the state, the pulsing solenoid and the pause time count-down, depending on the type of display mounted on the control unit. If the user enters in the settings menu, the cleaning operations will be stopped.

Parameters involved in Manual mode

ITEM	E1T	E2T	E5T	E6T	Unit
Mode	F01	F01	Operating mode	Operating mode	
Pulse Time	F02	F02	Pulse Time	Pulse Time	Msec
Pause Time	F03	F03	Pause Time	Pause Time	Sec
Outputs	F04	F04	No. of outputs	No. of outputs	

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3

Automatic

In "Automatic" operating mode, the control unit works autonomously, performing the cleaning cycle only when necessary. The cleaning cycle starts when the differential pressure read by the on-board sensor exceeds the "dP Start Cleaning" threshold value configured in the parameters.

The solenoids connected to the control unit will be activated sequentially in order to perform a cleaning cycle, with the timing values configured in the related parameters.
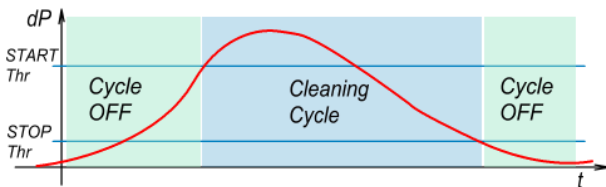

If the read dP pressure falls under the "dP Stop Cleaning" threshold configured in the parameters, the cleaning cycle will be stopped.

It will start again when the pressure will exceed the "dP Start Cleaning" threshold.

If the reading pressure is even greater than the "dP Stop Cleaning" threshold value, at the end of the last solenoid's activation, the cycle will continue starting again from the first solenoid.

Effect of the "Remote Enable" input contact
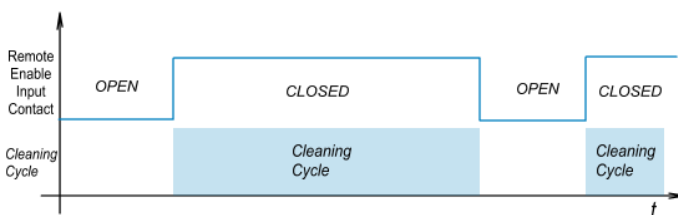
A cleaning cycle will be performed only if the Remote Enable input contact (terminals 14-15) is closed. If, during a cleaning cycle, the contact opens, it will stop all activities until the contact will close again. Then, the cleaning cycle will restart from the solenoid immediately after the last pulsed solenoid, if the cleaning requirements are still respected.

Effect of the "FAN OFF" input contact

If "FAN OFF" detection was set to use the input contact (terminals 12-13) and it is open at power-on, the control unit will wait the contact to be closed in order to start a cleaning cycle.
If during a cleaning cycle the normally closed "FAN OFF" input contact (terminals 12-13) opens, the cleaning will be stopped at the last pulsed solenoid and a post-cleaning (PCC) function will be performed, if configured to work. At the end of PCC, the control unit will wait the contact to be closed in order to start a new cleaning cycle.
It is possible to set "FAN OFF" detection by dP. Please see "Post Cleaning" paragraph for more information.

Displayed information

During a cleaning cycle, the display of the control unit shows the cleaning progress with some useful information, like the state, the pulsing solenoid and the pause time count-down, depending on the type of display mounted on the control unit. If the user enters in the settings menu, the cleaning operations will be stopped.

Parameters involved in Automatic mode

ITEM	E1T	E2T	E5T	E6T	Unit
Mode	F01	F01	Operating mode	Operating mode	
Pulse Time	F02	F02	Pulse Time	Pulse Time	Msec
Pause Time	F03	F03	Pause Time	Pause Time	Sec
Outputs	F04	F04	No. of outputs	No. of outputs	
Start dP	n/A	F08	n/A	dP Start cleaning threshold	KPa
Stop dP	n/A	F09	n/A	dP Stop cleaning threshold	KPa

Forced cycle

In Forced operating mode, the control unit works in a way similar to the Automatic mode, performing an automatic cleaning cycles when required by settings OR performing a single cleaning cycle every few minutes or hours, depending on the time base set in the parameters.

The purpose of this operating mode is to ensure that at least once every scheduled period, a cleaning cycle will always be performed, even if an automatic cleaning cycle was never started.

Ts= Pulse Time

Tp= Pause Time

EV = Nr of solenoids

Tenforc = time for Forced cycle (in minutes OR hours)
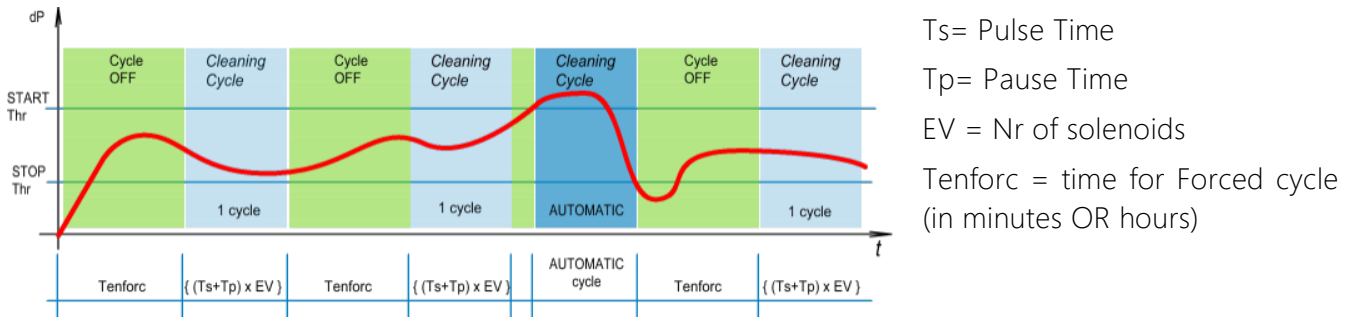
In Forced cycle, the control unit works in this way:

Case 1: no conditions to start an automatic cycle

The control unit is placed in stand-by. When "Tenforc" minutes (or hours, depending on the settings) is elapsed, it will perform one single cleaning cycle. After that, the control unit will return in stand-by and it will repeat one single cleaning cycle after another Tenforc is elapsed. This job will continue indefinitely, observing Tenforc time between singles cleaning cycles.

Case 2: conditions to start an automatic cycle

If during a Tenforc counting, the read dP pressure value exceeds the "dP Start cleaning" threshold, the control unit will start an automatic cleaning cycle. The cycle will stop only when the dP pressure read will fall under the "dP Stop cleaning" threshold. So, a new Tenforc counting will be started.

Displayed information

During a cleaning cycle, the display of the control unit shows the cleaning progress with some useful information, like the state, the pulsing solenoid and the pause time count-down, depending on the type of display mounted on the control unit. If the user enters in the settings menu, the cleaning operations will be stopped.

Parameters involved in Enforced mode

ITEM	E1T	E2T	E5T	E6T	Unit
Mode	F01	F01	Operating mode	Operating mode	
Pulse Time	F02	F02	Pulse Time	Pulse Time	Msec
Pause Time	F03	F03	Pause Time	Pause Time	Sec
Outputs	F04	F04	No. of outputs	No. of outputs	
Start dP	n/A	F08	n/A	dP Start cleaning threshold	KPa
Stop dP	n/A	F09	n/A	dP Stop cleaning threshold	KPa
Enf. Min/hh	n/A	F22	n/A	Forced cycle in	Min/Hours
Enf. Time	n/A	F23	n/A	Time for Forced Cycle	

APNt 030
EN Rev.1.1

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5

Proportional

In Proportional operating mode, the control unit works in a way similar to the Automatic mode, starting the cleaning cycle when the dP pressure read exceeds the "dP Start Cleaning" threshold.

The purpose of this function is to increase the speed of the cleaning cycle if a previous cleaning was not efficient as expected. It is possible to set a percentage of the efficiency with regard to the read dP.

If the read dP pressure is lower than this percentage, it means that the filter has been not sufficiently cleaned and it is necessary to increase the frequency of the cleaning.
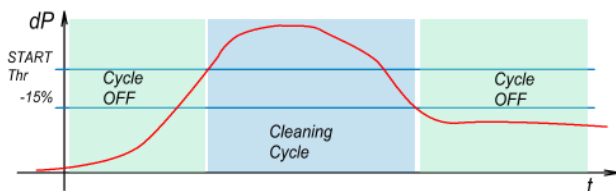
If, at the end of a solenoid pulse, the read dP pressure has decreased by more than the "dP Start cleaning" percentage compared to the value of previous read dP value, the cleaning cycle is stopped and then restarts at next exceeding same value.
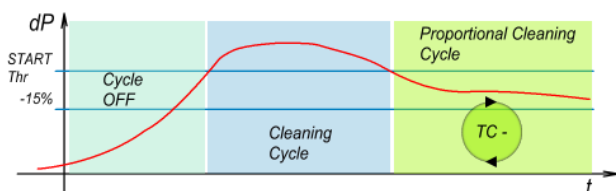
If the pressure does not fall below the "dP Start cleaning" percentage compared to the value of previous dP value read at the end of a pulse during the cycle, the control unit will reduce proportionally the pause time each pulsing until reaching a minimum time set in parameters. This limit has been set in order to avoid a critical condition for the air supply system (compressor) connected to the cleaning filter.

The "Proportional" mode takes the highest priority respect the "Automatic" cleaning cycle. This means that the Proportional parameters and calculated values could exclude some parameters set for "Automatic" mode.
The "Proportional" mode will terminate the cleaning cycle only when the dP pressure read will go under the percentage of the "dP Start Cleaning" with regard to the last read dP pressure, bypassing the "dP Stop cleaning" threshold if that has a greater value than the with percentage calculated one.

Displayed information

During a cleaning cycle, the display of the control unit shows the cleaning progress with some useful information, like the state, the pulsing solenoid and the pause time count-down, depending on the type of display mounted on the control unit. If the user enters in the settings menu, the cleaning operations will be stopped.

Parameters involved in Proportional mode

ITEM	E1T	E2T	E5T	E6T	Unit
Mode	F01	F01	Operating mode	Operating mode	
Pulse Time	F02	F02	Pulse Time	Pulse Time	Msec
Pause Time	F03	F03	Pause Time	Pause Time	Sec
Outputs	F04	F04	No. of outputs	No. of outputs	
Start dP	n/A	F08	n/A	dP Start cleaning threshold	KPa
Stop dP	n/A	F09	n/A	dP Stop cleaning threshold	KPa
Prop % dP	n/A	F61	n/A	Percentage of dP for stop cycle	%
Prop % Time	n/A	F62	n/A	Percentage of pause Time decrement	% (sec)
Prop min Time	n/A	F63	n/A	Minimum pause time	Sec

Post Cleaning (PCC)

This function allows to perform a cleaning cycle after the fan was stopped (OFF state) by the user.
The PCC function is enabled if the value configured in "PCC Cycles" was set with a value different from zero. This parameter determines how many PCC cycles will be performed.

If the Control Unit was configured to work in "MANUAL" mode, the PCC cycle will be performed only if the Fan input contact (terminals 12-13) will be opened.
Otherwise, the PCC cycle will be performed if the read dP pressure falls under "Fan threshold" value.
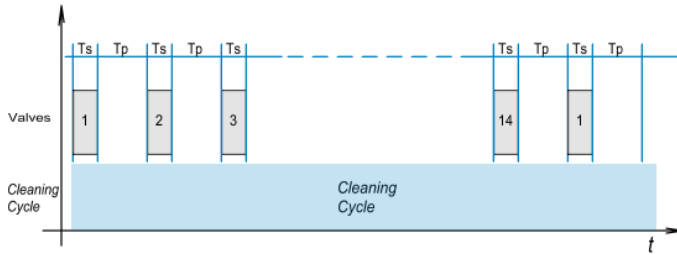

The Post Cleaning cycle Pause time (Tp) is available to be set in order to perform a different cycle timing than the standard cleaning cycle. The Pulse Time (Ts) is the same previously set for a standard cleaning cycle.
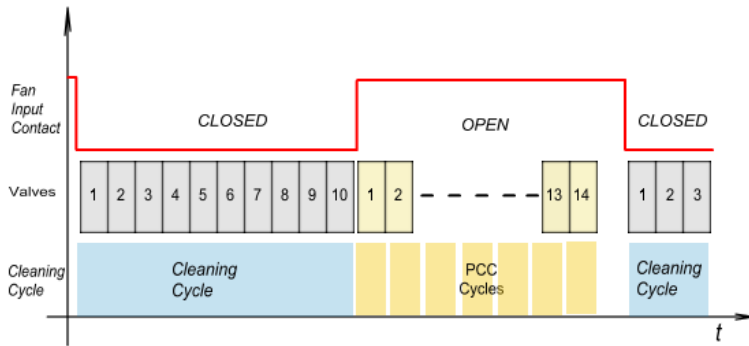
PCC handled by "FAN OFF" input contact
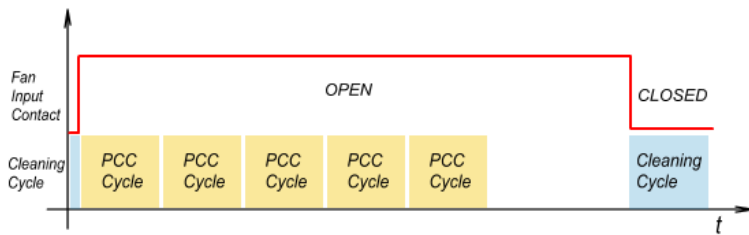
The number of the Post Cleaning cycles to perform can be set with "PCC Cycles" parameter. At the end of the last Post cleaning cycle, the Control Unit will stop all activities until the Fan input contact is detected as closed, or the read dP pressure exceeds the "Fan threshold" value. Then, a new standard cleaning can start, if required.
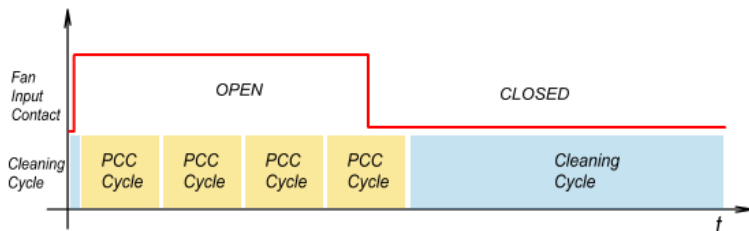
If the Fan Input Contact is detected as closed while a Post Cleaning Cycle is in progress, it stops immediately and a new standard cleaning cycle will be started, if required.
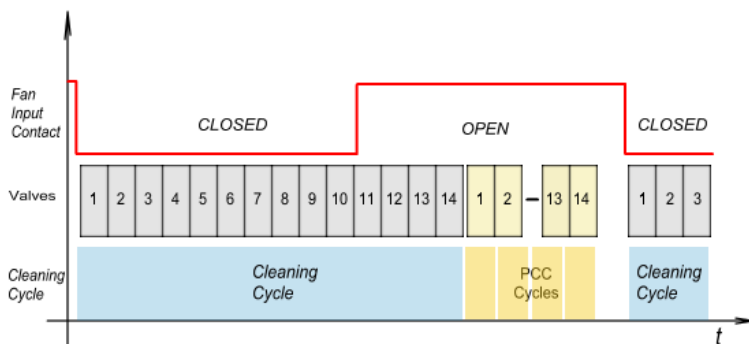
This is a typical "MANUAL" mode sequence where a cleaning cycle is in progress (14 solenoids) and the Fan input contact goes open. The Post Cleaning cycles will start when current cleaning cycle is completed. This because the "end cycle" parameter is set as stop at the end of the cycle. After the PCC, the control unit will wait the fan input contact to be closed again to start a new standard cleaning cycle.

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7

This is a typical "MANUAL" mode sequence where a cleaning cycle is in progress (14 solenoids) and the Fan input contact goes open. The Post Cleaning cycles will start immediately. This because the "end cycle" parameter is set as immediate stop. After the PCC, the control unit will wait the fan input contact to be closed again to start a new standard cleaning cycle.

PCC handled by "FAN OFF" dP threshold
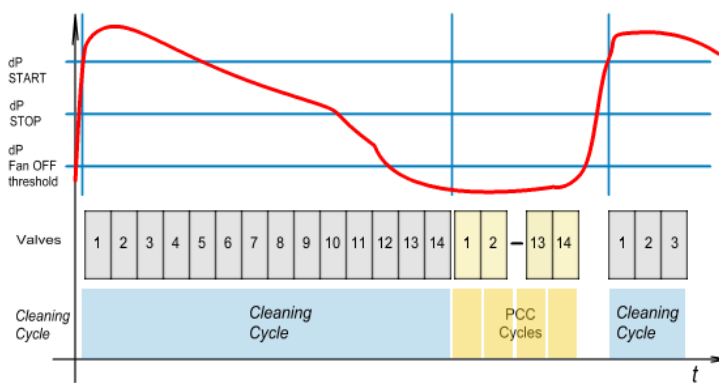
The Post Cleaning cycle will be performed if the read dP pressure goes under the "Fan OFF threshold" value and if at least one time from the power-on the read dP pressure has exceeded the "Fan OFF threshold" value.

At the end of a Post cleaning cycle, the control unit will wait again to exceed the "Fan OFF threshold" to enable the next post cleaning if required by the conditions.

Only PCC cleaning cycle

It is possible to set "Enable cycle" parameter to zero in order to perform only PCC cycle, disabling all the other cleaning modes.

Displayed information

During a cleaning cycle, the display of the control unit shows the PCC cleaning progress with some useful information, like the state, the pulsing solenoid and the pause time count-down, depending on the type of display mounted on the control unit. If the user enters in the settings menu, the cleaning operations will be stopped.

Parameters involved in PCC mode

ITEM	E1T	E2T	E5T	E6T	Unit
Mode	F01	F01	Operating mode	Operating mode	
Pulse Time	F02	F02	Pulse Time	Pulse Time	Msec
Pause Time	F03	F03	Pause Time	Pause Time	Sec
Outputs	F04	F04	No. of outputs	No. of outputs	
Start dP	n/A	F08	n/A	dP Start cleaning threshold	KPa
Stop dP	n/A	F09	n/A	dP Stop cleaning threshold	KPa
FAN mode	F11	F11	Fan mode	Fan mode	
FAN threshold	n/A	F12	n/A	Fan threshold	KPa
PCC cycles	F13	F13	PCC cycles	PCC cycles	
PCC Pause Time	F14	F14	Pause in PCC	Pause in PCC	Sec
Cycle End mode	F53	F53	Cycle End mode	Cycle End mode	
Enable cleaning	F64	F64	Enable cycle	Enable cycle	

Pre-coating

This function allows to activate a precoating function, a specific treatment of the filter elements that is performed with a material suitable for the purpose, called "precoating powder".

If pre-coating is enabled, the control unit will read the dP pressure value and wait until that value exceeds the pre-coating threshold before to enable and perform a standard cleaning cycle in both Manual or Automatic modes.
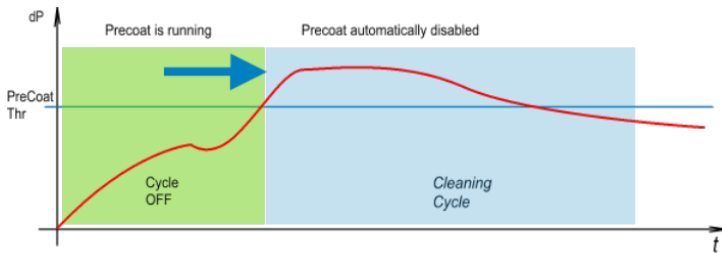
After the standard cleaning cycle is started, the pre-coating function will be automatically disabled.
No cleaning cycle will be performed if the programmed threshold is not exceeded during precoating.

Displayed information

During a precoating function, the display of the control unit shows "PC" message or the cleaning progress with some useful information, like the state, the pulsing solenoid and the pause time count-down, depending on the type of display mounted on the control unit. If the user enters in the settings menu, the operations will be stopped.

Parameters involved in Pre-coating mode

ITEM	E1T	E2T	E5T	E6T	Unit
Mode	F01	F01	Operating mode	Operating mode	
Pulse Time	F02	F02	Pulse Time	Pulse Time	Msec
Pause Time	F03	F03	Pause Time	Pause Time	Sec
Outputs	F04	F04	No. of outputs	No. of outputs	
Precoat Enable	F18	F18	Precoating	Precoating	
Precoat Threshold	F19	F19	Precoating Thold	Precoating Thold	KPa

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9

Notes:

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10

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APNt 030
Rev.1.1 EN