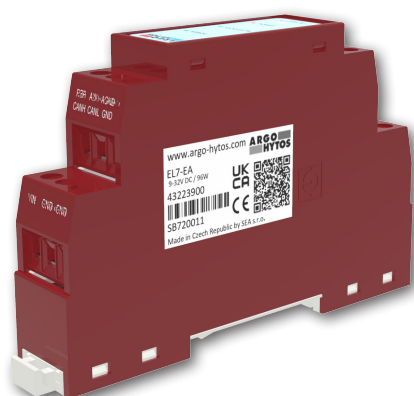# EL7-E

ARGO HYTOS
A Voith Company

Technical Features

› Digital electronic control unit for connection to DIN rail, designed to control of single or double solenoid hydraulic valves
› Wide range of supply voltage from 9 up to 32 V DC
› Easy parameter setting via Bluetooth – class 2
› Android + iOS application for parameter setting and monitoring, also suitable for servicing
› Controlled by analogue input command signal or by connection to CAN bus line (protocol EN 50325-4 + DS408)
› Optional type of input command signal
› Wide setting range of frequency 80 … 1000 Hz of PWM output control signal to solenoid coil
› Amplitude and frequency of dither are adjustable separately for each solenoid (at the fixed PWM frequency 15 kHz)
› Resistant to interferences, electrostatic discharge and quick transiens
› Flexible and reliable function of system achieved by using a fast 32-bit ultra-low-power processor
› The 12-bit A/D converter assures high resolution and accuracy conversion of input command signal

Functional Description

The digital electronic control unit is designed to control single or double solenoid hydraulic valves in a open control loop without feedback.
The advantage is the standardised design for mounting to DIN rail. Parameter setting, such as selecting the type of input command signal, setting the ramp function or PWM frequency of output control signal, is performed via Bluetooth in the application designed for installation on android and iOS. The application also enables parameter monitoring, which is advantageous especially in installing or servicing the equipment. The coil control with PWM signal reduces energy consumption, coil heating, hysteresis and increases the control accuracy.

Technical Data

Operating supply voltage Ucc	V DC	9 …32	
Reference voltage Uref	V DC	5	
Max. current at Uref	mA	20	
Type of input command signal (see table page 3)		0 … 20 mA, 4 … 20 mA, 0 … +5 V DC, ± 5 V DC, 0 … 10 V DC, ± 10 V DC, Ucc/2 ± 5 V DC, Ucc/2 ± 10 V DC	
Max. output current / 1 coil	A	3	
PWM frequency	Hz	80 … 1000	
Resolution of A/D converters	bit	12	
Ramp function	s	0 … 45	
Dither – amplitude *	% from Imax	0 … 30 % from Imax	
Dither – frequency *	Hz	60 … 300	
Linearity	%	1	
Ambient operating temperature	°C (°F)	-40 … +80 (-40 … +176)	
Ingress protection code (IP) EN 60529		IP 20	
Weight	kg (lbs)	0.05 (0.11)	
Nominal voltage of coil	V	12 DC	24 DC
Limit current through the valve coil	PRM2-04	A	(coil 16186100) … 1.7	(coil 16186200) … 0.8
	PRM2-06		(coil 16187500) …1.6	(coil 16186800) …1.0
	PRM6-10		(coil 16195800) … 1.9	(coil 16196200) … 1.1
	PRL1-06		-	-
	PRL2-06		-	-

* When dither is activated, the PWM frequency is automatically set to 15 kHz
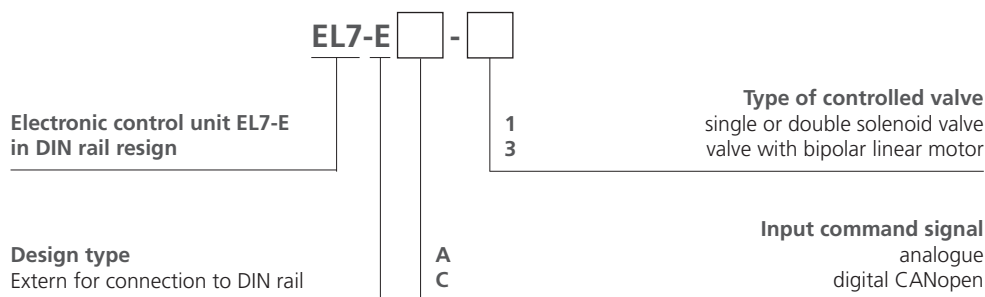
Performed type tests

1. Electromagnetic interference immunity and electric strength

Standard	Standard name
DIN EN 61000-4-2	Test Standard for Electrostatic Discharge (ESD) Immunity
DIN EN 61000-4-3	Radiated, Radiofrequency, Electromagnetic Field Immunity Test
DIN EN 61000-4-4	Electrical Fast Transient (EFT) / EMC Burst Immunity Test Standard
DIN EN 61000-4-5	Surge Immunity Test
DIN EN 61000-4-6	Immunity to Conducted Disturbances, Induced by Radio Frequency Fields
DIN EN 61000-4-8	Power Frequency Magnetic Field Immunity Test
2. Electromagnetic compatibility (EMC)	
EN 61000-6-2	Electromagnetic compatibility (EMC). Part 6-2: Generic standards. Immunity standard for industrial environments
EN 61000-6-4	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments

EL7-E□□ - □

Electronic control unit EL7-E in DIN rail resign	

1 single or double solenoid valve
3 valve with bipolar linear motor

Type of controlled valve

Design type
Extern for connection to DIN rail

A analogue
C digital CANopen

Input command signal

Types of extern electronic control unit

Electronics	Controlled valve
EL7-EA-1	Single or double solenoid valve and an analogue input command signal
EL7-EC-1	Single or double solenoid valve for connection to CAN bus line
EL7-EA-3	Valve with a bipolar linear motor and an analogue input command signal
EL7-EC-3	Valve with a bipolar linear motor for connection to CAN bus line

Connection of electronic control unit - Dimensions in millimeters (inches)

INPUTS

Terminal description	Input analogue signal
REF	Output Uref = 5 V DC
AIN	Input command signal
AGND	Command signal GND
VIN	Supply voltage +Ucc
GND	Supply GND

Terminal description	Connection to CAN line
CANH	CAN HIGH
CANL	CAN LOW
GND	CAN GND
VIN	Supply voltage +Ucc
GND	Supply GND

OUTPUTS

Terminal description	Output PWM signal to solenoid A and B
A- / A+	Outputs for A solenoid connection
B- / B+	Outputs for B solenoid connection
SHILD	Cable shielding

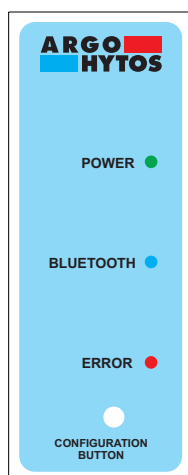| Terminal description	Output PWM signal for coil connection of bipolar solenoid
L / L	Outputs for coil connection of bipolar solenoid
SHILD	Cable shielding

INPUTS
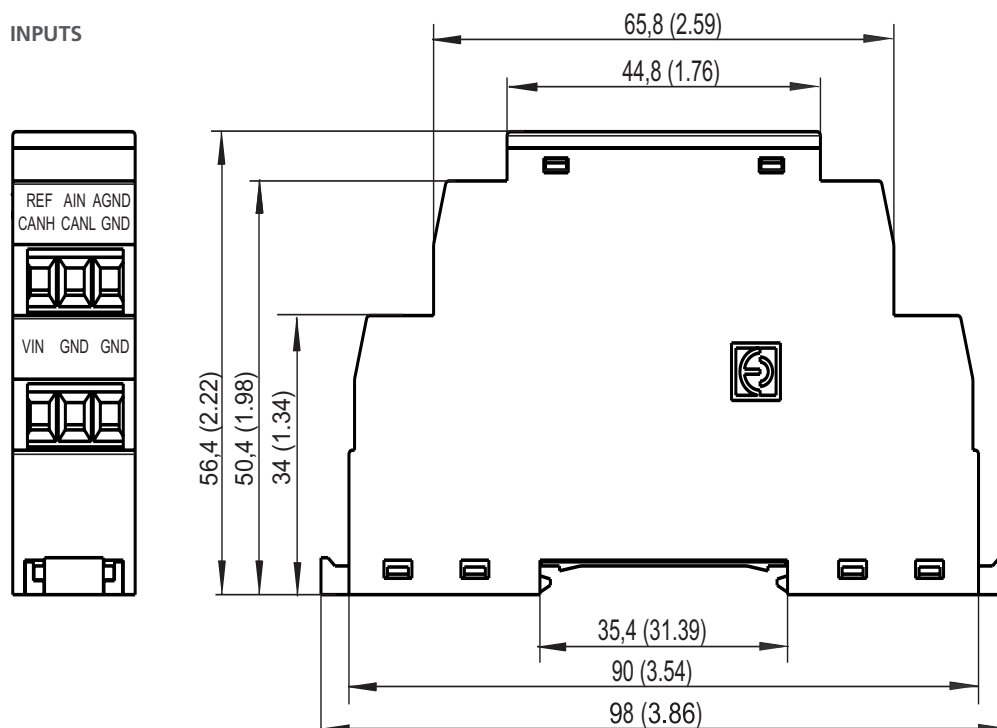
OUTPUTS
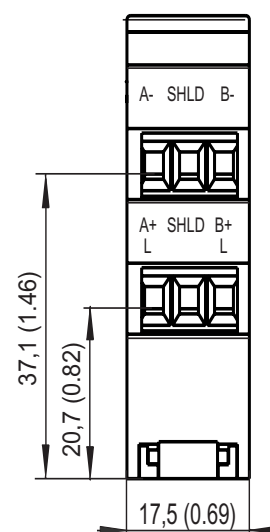
LED mode indication

LED	Meaning
Green (PWR)	A lit LED indicates power (Ucc), flashes when the supply voltage is less than 9 or more than 32 V DC
Blue (BT)	LED flashes – Bluetooth is unpaired / LED is lit - Bluetooth is paired
Red (ERR)	LED is lit – error status (current signal out of specified range, solenoid coil disconnected)

ARGO HYTOS

POWER ●

BLUETOOTH ●

ERROR ●

○

CONFIGURATION BUTTON

Block diagram EL7

IN   type selection of input command signal (and controlled valve)
+/-   polarity inverting of input command signal
PN   insensitivity zone (dead band) setting
OFFSET   position setting of the characteristic
GAIN   gain (amplification) setting
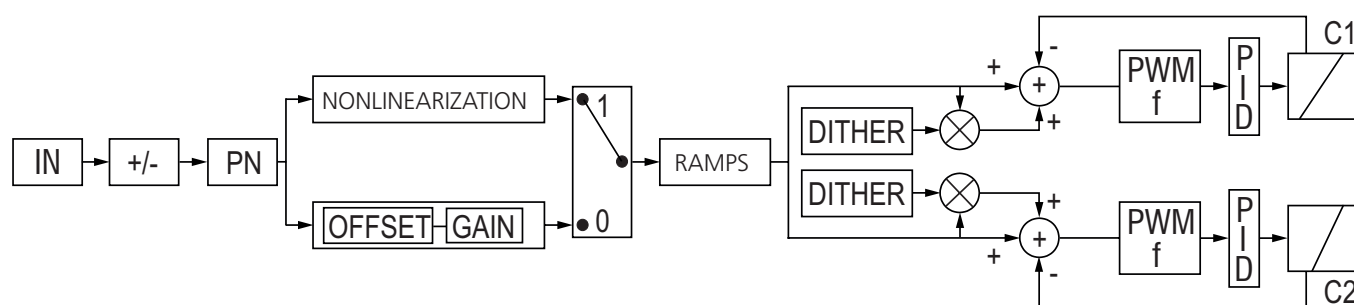
RAMP	0 - 45 s
DITHER	60 - 300 Hz / 0 - 30 % of the amplitude
PWM frequency	80 - 1000 Hz / 15 kHz when the dither is used
PID	setting the PID controller parameters
C1, C2	coils of valve solenoids

Supply voltage	9 ... 32 V DC
Operating temperature	-40 ... +80 °C (-40 ... +176)

Adjustable parameters of electronic control unit

Command signal setting

Valve type	EL7 type	Input command signal
Single solenoid valve with an analogue input signal	EL7-EA-1	0 … 20 mA 4 ….20 mA 0 ± 10 mA 0 ± 10 V DC -10 ... +10 V DC Ucc/2 ± 10 V DC Ucc/2 ± 5 V DC 0 ….5 V DC*
Double solenoid valve with an analogue input signal	EL7-EA-1	10 ± 10 mA 12 ± 8 mA 0 ± 10 mA 5 ± 5 V DC
Valve with bipolar linear motor and an analogue input signal	EL7-EA-3	0 ± 10 V DC Ucc/2 ± 10 V DC Ucc/2 ± 5 V DC 2.5 ± 2.5 V DC*
Single solenoid valve with a digital input signal (CAN)	EL7-EC-1	The type of input command signal is not selected. The input signal is generated in a digital form by control unit of machine.
Double solenoid valve with a digital input signal (CAN)	EL7-EC-1	
Valve with bipolar linear motor and a digital input signal (CAN)	EL7-EC-3	

* inputs primarily intended for control using Uref

**Polarity inverting of the input command signal**

In the case of single solenoid valve the input command signal is inverted.
In the case of double solenoid valve or a valve with a bipolar linear motor the inverted input command signal changes the movement direction of piston rod of controlled hydraulic cylinder or rotation direction of shaft of hydraulic motor.

Insensitivity zone (dead band) setting

This function allows setting the width of the area around zero point (in % of the maximum value of input command signal), in which the output control signal for valve coils is equal to zero.
The function is used in the practise as a measure against excessive sensitivity and for stability increasing of regulated system.

I_{out} [mA]
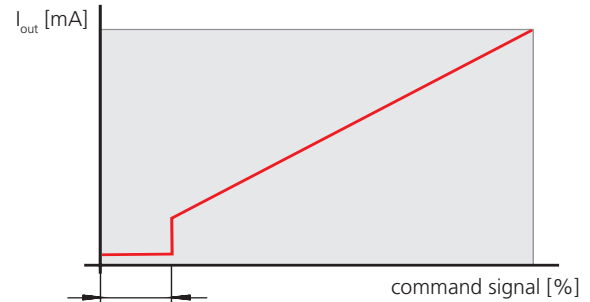
command signal [%]

Linearization function

The function can be switched off. When is on, the shape of the characteristic „output control signal as a function of input command signal" can be modified by entering ten values of input signal.

Gain (amplification) setting

The function allows to set a velocity of rising of the output control signal with increasing input command signal in the range 0 < gain ≤ 4

I_{out} [mA]

>1   1

<1

command signal [%]
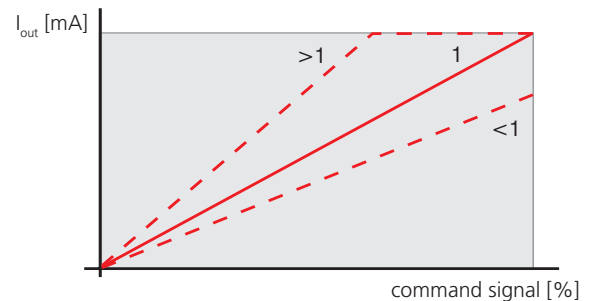
Default position of characteristic (Offset)

The function allows to set the default position of characteristic by moving in the vertical direction.
This function can be used to elimination of insensitivity zone around zero point, caused by overlap of spool control edges.

I_{out} [mA]

offset

command signal [%]
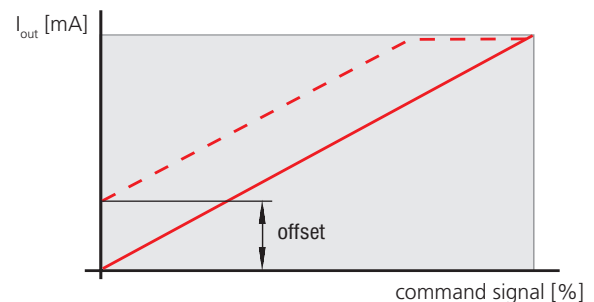
Ramp function

The function allows to define a time in the range from 0 up to 45s, which is needed for increase of input (and output) signal from zero to maximum and vice versa. The setting of ascending and descending part of characteristic reduces the dynamic transiens and protects the circuit against mechanical stress.

I_{out}

0   45   T [s]

I_{out}

0   45   T [s]
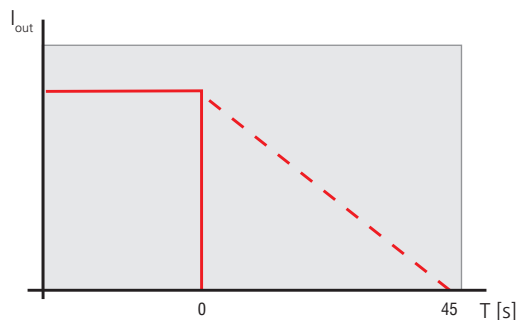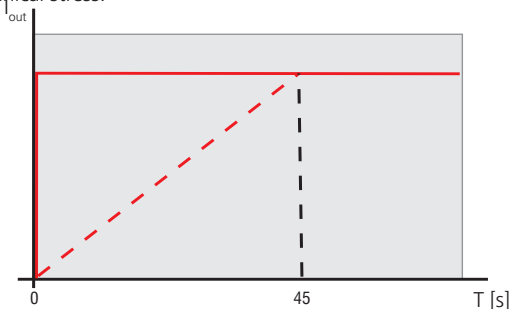
Dither

The function dither significantly reduces the effect of adhesive forces on the solenoid armature and valve spool. The adhesive oil layer counteracts the increasing solenoid force and thus prevents movement in the range of small actuating current. The permanent vibration of the armature, induced by current pulses of high frequency and low amplitude through the coil, significantly reduces the insensitivity zone. The frequency can be set from 60 up 300 Hz, the amplitude from 0 up to 30% of maximum coil current. When the dither function is switched on, the PWM frequency of output control signal is automatically set to the value 15 kHz.

Frequency setting of PWM output control signal to the valve coils

A pulse width modulated (PWM) signal is used as a output control signal. Its frequency can be set in the range from 80 to 1000 Hz. The PWM signal reduces coil heating and improves the dynamic of valve control.

PID controller

The setting of constant of individual components of PID controller is performer by the manufacturer within the initial setting and final functional test. However, the user can change the set parameters with the help of application.

Coil limit current setting

The function is used as a protection of coil winding from current overloading but can also be used for setting of limited coil power. The maximum current value must not exceed the value indicated on the coil mantle.
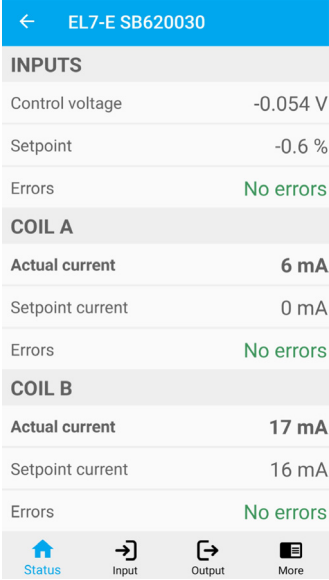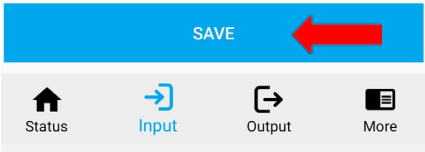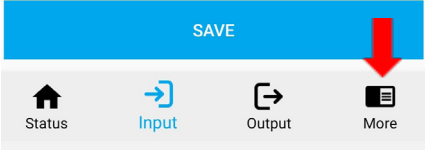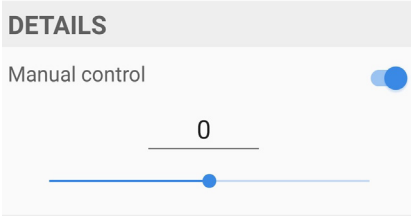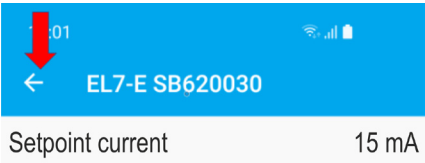
Download the application for setting parameters

The application, which is stored in Android Market and Apple Store, can be obtained by reading the QR-code according to the type of your device.

Setting parameters of ECU using the application

Scan **EL7-E SB620026** S-EL7-EMBD **EL7-E SB620030** S-EL7-EMBD **EL7-I SB720007** S-EL7-DIN	Before getting in to the application itself do not forget to turn on your Bluetooth and Location setting on your smartphone. Right after loading of the application, follow the instructions displayed on the screen of your device and select desired ECU in the list of shown reachable devices.
EL7-E SB620030 Valve status monitoring and configuration are password protected. Enter password: LOGIN S-EL7-DIN V1.55.2.1	You will be asked for password by the application. For default setting use password 1234.

EL7-E SB620030 **INPUTS** Control voltage — -0.054 V Setpoint — -0.6 % Errors — No errors **COIL A** **Actual current** — **6 mA** Setpoint current — 0 mA Errors — No errors **COIL B** **Actual current** — **17 mA** Setpoint current — 16 mA Errors — No errors Status · Input · Output · More	After logging in you will be displayed actual status page of EL7, including error message status. Use the icons below for switching between themselves.
SAVE ← Status · Input · Output · More	Changed settings can be saved in the memory of EL7 after clicking on button „Save".
SAVE ↓ Status · Input · Output · More	After the click on the button „MORE" you can personalize your device by setting name, password, update firmware or download system log.
DETAILS Manual control 0	By checking the box of „Manual control" the regulated valve will stop responding to the external command signal and will only be controlled by slider in the application. To return to an external control is necessary to untick the option of „Manual control".
:01 ← **EL7-E SB620030** Setpoint current — 15 mA	After setting the required parameters, you can quit the application or start a parametrization of another ECU.