



EFX 1640 Electronic Controller

Programmed with Eaton CONTROL F(x)TM to IEC 61131-3 Standard

2nd CAN interface for gateway function according to SAE J 1939
Supply voltage 10...32V DC

TECHNICAL DATA	CONTROLLER FOR THE IMPLEMENTATION OF A CENTRAL OR DECENTRALIZED ELECTRO-HYDRAULIC SYSTEM																								
Housing	closed, screened metal housing with flange fastening																								
Dimensions (H x W x D)	153 x 226 x 43 mm																								
Mounting	screw connection by means of 4 M5xL screws according to DIN 7500 or DIN 7984 mounting position horizontal or vertical to the mounting wall																								
Connection	55-pin connector, latched, protected against reverse polarity, type AMP or Framatome AMP junior timer contacts, crimp connection 0.5/2.5 mm ²																								
Weight	1.2 kg																								
Housing / storage temperature	- 40...85 °C (depending on the load) / - 40...85 °C																								
Protection	IP 67 (for inserted plug with individually sealed cores e.g. ECEFX16 12S)																								
Input / output channels total	max. 40 (the total number which is available depends on the wiring and configuration of the controller)																								
Inputs possible configurations	max. 40 (corr. to 0 outputs)																								
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Outputs possible configurations	max. 24 (corr. to 0 outputs)																				
Abbreviations A = analogue B _H = binary High Side B _L = binary Low Side FRQ/CYL = frequency inputs I _H = pulse High Side I _L = pulse Low Side PWM = pulse width modulation PWM _I = current-controlled output %IWx = IEC address for analogue input %IX0.xx = IEC address for binary input %QX0.xx = IEC address for binary output	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding: 5px;">Number</th> <th style="text-align: left; padding: 5px;">Signal</th> <th style="text-align: left; padding: 5px;">Version</th> <th style="text-align: left; padding: 5px;"></th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">8 or or</td> <td style="padding: 5px;">digital PWM current-controlled</td> <td style="padding: 5px;">positive switching (High Side), with diagnostic capability PWM frequency 20...250 Hz 0,1...4 A</td> <td style="padding: 5px;">B_H PWM PWM_I</td> </tr> <tr> <td style="padding: 5px;">8</td> <td style="padding: 5px;">digital</td> <td style="padding: 5px;">positive switching (High Side), with diagnostic capability</td> <td style="padding: 5px;">B_H</td> </tr> <tr> <td style="padding: 5px;">4 or</td> <td style="padding: 5px;">digital PWM</td> <td style="padding: 5px;">positive switching (High Side), with diagnostic capability PWM frequency 20...250 Hz</td> <td style="padding: 5px;">B_H PWM</td> </tr> <tr> <td style="padding: 5px;">4</td> <td style="padding: 5px;">digital</td> <td style="padding: 5px;">positive/negative switching (High/Low Side) with diagnostic capability (can also be used as H bridge)</td> <td style="padding: 5px;">B_{H/L} H bridge</td> </tr> </tbody> </table>	Number	Signal	Version		8 or or	digital PWM current-controlled	positive switching (High Side), with diagnostic capability PWM frequency 20...250 Hz 0,1...4 A	B _H PWM PWM _I	8	digital	positive switching (High Side), with diagnostic capability	B _H	4 or	digital PWM	positive switching (High Side), with diagnostic capability PWM frequency 20...250 Hz	B _H PWM	4	digital	positive/negative switching (High/Low Side) with diagnostic capability (can also be used as H bridge)	B _{H/L} H bridge
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EFX 1640**Technical data**

Operating voltage U_B overvoltage undervoltage detection switching-off in case of undervoltage	10...32 V DC 36 V for $t \leq 10$ s for $U_B \leq 10$ V for $U_B \leq 8$ V																		
Current consumption	≤ 160 mA (without external load at 24 V DC)																		
CAN interface 1 Baud rate Communication profile	CAN interface 2.0 B, ISO 11898 50 Kbits/s...1 Mbits/s (default setting 125 Kbits/s) CANopen, CiA DS 301 version 4, CiA DS 401 version 1.4																		
Node-ID (CANopen)	hex 7F (= dec. 127)																		
CAN interface 2 Baud rate Communication profile	CAN interface 2.0 A/B, ISO 11898 50 Kbits/s...1 Mbits/s (default setting 125 Kbits/s) SAE J 1939 or free protocol																		
Serial interface Baud rate Topology Protocol	RS-232 C 9.6 / 19.2 / 28.8 / 38.4 / 57.6 kBit/s (default setting 9.6 Kbits/s) point-to-point (max. 2 participants); master-slave connection predefined ifm protocol (INTELHEX)																		
Processor	CMOS microcontroller 16 bits C167CS cycle frequency 20/40 MHz																		
Device monitoring	undervoltage monitoring, watchdog function, check sum test for program, and system excess temperature monitoring																		
Process monitoring concept	Two relays according to EN 954 monitor two groups of 12 outputs each																		
Program memory	768 Kbytes Flash can be used by the user (+ 832 Kbytes for extended functions)																		
Data memory	128 Kbytes SRAM, 128 Kbytes Flash																		
Data memory (protected in case of power failure)	1024 bytes (retain data), 16 Kbytes (general data)																		
Status indication	three-colour LED (R/G/B)																		
Operating status (status LED)	<table border="1"> <thead> <tr> <th>LED Color</th> <th>Status</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>–</td> <td>off</td> <td>no operating voltage</td> </tr> <tr> <td>yellow</td> <td>1 x on</td> <td>initialisation or reset checks</td> </tr> <tr> <td>green</td> <td>5 Hz</td> <td>no operating system loaded</td> </tr> <tr> <td>green</td> <td>2.0 Hz on</td> <td>Run Stop</td> </tr> <tr> <td>red</td> <td>2.0 Hz on</td> <td>Run with error Fatal error or stop with error</td> </tr> </tbody> </table>	LED Color	Status	Description	–	off	no operating voltage	yellow	1 x on	initialisation or reset checks	green	5 Hz	no operating system loaded	green	2.0 Hz on	Run Stop	red	2.0 Hz on	Run with error Fatal error or stop with error
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Test standards and regulations

Climatic test	Damp heat to EN 60068-2-30, test Db ($\leq 95\%$ rel. humidity, non-condensing) Salt mist test to EN 60068-2-52, test Kb, severity level 3 Degree of protection to EN 60529
Mechanical resistance	Vibration to EN 60068-2-6, test Fc, Shock to EN 60068-2-27, test Ea, Bump to EN 60068-2-29, test Eb
Immunity to conducted interference	to ISO 7637-2, pulses 2, 3a, 3b, severity level 4, function state A to ISO 7637-2, pulse 5, severity level 1, function state A to ISO 7637-2, pulse 1, severity level 4, function state C
Immunity to interfering fields	directive 95/54/EC at 100 V/m (e1 type approval) and EN 61000-6-2 :2001 (CE)
Interference emission	directive 95/54/EC (e1 type approval) and EN 61000-6-3 :2001 (CE)
Tests for the approval for railway applications	to BN 411 002 (DIN EN 50155 clause 10.2)

EFX 1640**Characteristics of the inputs****Digital/analog inputs (B_I, A)**

%IW03...10

%IX0.00...07

can be configured as ...

■ Voltage inputs

input voltage	0...10/32 V
resolution	12 bits
precision	± 1.0% FS
input resistance	50/30 kΩ
input frequency	50 Hz

■ Current inputs

input current	0/4...20 mA
resolution	12 bits
precision	± 1.0% FS
input resistance	400 Ω
input frequency	50 Hz

■ Digital inputs for positive sensor signals, with diagnostic capability*

switch-on level	0.7 U _B
switch-off level	0.4 U _B
input resistance	30 kΩ
input frequency	50 Hz

Digital inputs (B_I)

%IX0.08...11

%IX1.00...03

can be configured as ...

■ Digital inputs for positive sensor signals

switch-on level	0.43...0.73 U _B
switch-off level	0.29 U _B
input resistance	3.21 kΩ
input frequency	50 Hz

Digital inputs (B_I, I_I)

%IX0.12...15

can be configured as ...

■ Digital inputs for positive sensor signals, with diagnostic capability*

switch-on level	0.7 U _B
switch-off level	0.4 U _B
input resistance	2.86 kΩ
input frequency	50 Hz

■ Frequency inputs for positive sensor signals with diagnostic capability, evaluation with integrated comparator

switch-on level	0.43...0.73 U _B
switch-off level	0.29 U _B
input resistance	2.86 kΩ
input frequency	max. 50 Hz

Digital inputs (B_{I/II}, I_I)

%IX1.04...07

can be configured as ...

■ Digital inputs for positive/negative sensor signals, positive with diagnostic capability*

switch-on level	0.7 U _B
switch-off level	0.4 U _B
input resistance	3.21 kΩ
input frequency	50 Hz

■ Frequency inputs for positive sensor signals with diagnostic capability, evaluation with integrated comparator

switch-on level	0.43...0.73 U _B
switch-off level	0.29 U _B
input resistance	3.21 kΩ
input frequency	50 Hz

Digital inputs (B_I)

%IX2.00...07

can be configured as ...

■ Digital inputs for positive/negative sensor signals, positive with diagnostic capability*

switch-on level	0.7 U _B
switch-off level	0.4 U _B
input resistance	3.21 kΩ
input frequency	50 Hz

Digital inputs (B_{I/II})

%IX1.08...15

can be configured as ...

■ Digital inputs for positive/negative sensor signals, positive with diagnostic capability*

switch-on level	0.43...0.73 U _B
switch-off level	0.29 U _B
input resistance	3.21 kΩ
input frequency	50 Hz

Test input

During the test mode (e.g. programming) the "TEST" connection must be connected to VBB_s (10...32 V DC).

For the "RUN" mode the test input must not be connected.

input resistance 3.21 kΩ

***NAMUR inputs**

■ Digital inputs with diagnostic capability can be used as NAMUR inputs when used with an external resistor connection.

supply voltage 5...25 V

wiring see page 5

EFX 1640**Characteristics of the outputs****Outputs (B_H, PWM, PWM_I)**

%QX0.00...07

can be configured as ...

■ Semiconductor outputs, with diagnostic capability positive switching (high side), short-circuit and overload protected

switching voltage 10...32 V DC
switching current max. 4 A
output frequency max. 100 Hz (depending on the load)

■ PWM outputs, diagnosis via current feedback

PWM frequency max. 250 Hz
mark-to-space ratio 1...99 %
resolution depends on the PWM frequency
load current max. 4 A
integrated pull-down resistor (4.7 kΩ)

■ Current-controlled outputs, diagnosis via current feedback

load current 0,1...4 A
load resistance min. 3 Ω (at UB = 12 V DC)
min. 6 Ω (at UB = 24 V DC)
setting resolution 1 mA
control resolution 5 mA
accuracy ± 2% FS

Outputs (B_H)

%QX0.08...15

can be configured as ...

■ Semiconductor outputs, with diagnostic capability positive switching (high side), short-circuit and overload protected

switching voltage 10...32 V DC
switching current max. 2 A
output frequency max. 100 Hz (depending on the load)

Outputs (B_H, PWM)

%QX1.00, 03, 04, 07

can be configured as ...

■ Semiconductor outputs, with diagnostic capability positive switching (high side), short-circuit and overload protected

switching voltage 10...32 V DC
switching current max. 4 A
output frequency max. 100 Hz (depending on the load)

■ PWM outputs

PWM frequency max. 250 Hz
mark-to-space ratio 1...99 %
resolution depends on the PWM frequency
load current max. 4 A

Outputs (B_{NL})

%QX1.01, 02, 05, 06

can be configured as ...

■ Semiconductor outputs, with diagnostic capability positive/negative switching (high side), short-circuit and overload protected

switching voltage 10...32 V DC
switching current max. 4 A
output frequency max. 100 Hz (depending on the load)

Overload protection

(valid for all outputs)

max. 5 minutes (at 100%)

Internal relay outputs

for electrically isolated

deactivation of the outputs

Normally open contacts in series to 2 groups of 12 semiconductor outputs.
Sustained forcing by means of hardware and additional controlling by means of user program.

The relays must always be switched without load!

total current max. 12 A per group
switching current 0.1...15 A
overload current 20 A
number of operating cycles ≥ 10⁶ (without load)
switching-time constant ≤ 3 ms

Output Error

■ Semiconductor output, positive switching (high side)

switching voltage 10...32 V DC
switching current max. 100 mA
overload current 0.5 A
switching function OFF (0 V) in case of an error
wiring see page 5

Abbreviations

A = analogue
B_H = binary High Side
B_L = binary Low Side
FRQ/CYL = frequency inputs
I_H = pulse High Side
I_L = pulse Low Side
PWM = pulse width modulation
PWM_I = current-controlled output
%IWx = IEC address for analogue input
%IX0.xx = IEC address for binary input
%QX0.xx = IEC address for binary output

Wiring

Pin	Potential	Description	Note
23	VBB _s (10...32 V DC)	Supply sensors and module	
05	VBB _p (10...32 V DC)	Supply outputs	Relay switched (1)
34	VBB _n (10...32 V DC)	Supply via relay	Relay switched (2)
01	GND _s	Ground sensors and module	
15	GND _n	Ground outputs	
12	GND _a	Ground analogue outputs	

CAN, RS-232, ERROR, TEST

Pin	Potential	Description	Note
14	CAN1 _H	CAN-Interface 1 (High)	
32	CAN1 _L	CAN-Interface 1 (Low)	
26	CAN2 _H	CAN-Interface 2 (High)	SAE J 1939
25	CAN2 _L	CAN-Interface 2 (Low)	SAE J 1939
33	GND	Ground (RS-232/CAN)	
06	RxD	RS-232 Interface (programming)	Pin 03, PC D-Sub (9 pin)
07	TxD	RS-232 Interface (programming)	Pin 02, PC D-Sub (9 pin)
13	ERROR	Error output B H	
24	TEST	Test input	

Inputs/Outputs

Pin	INPUTS	Configuration	OUTPUTS	Configuration	Diagnostic capability*	Relay switched INPUT / OUTPUT
08	%IX0.00 / %IW03	B _L A	–	–	• / –	
27	%IX0.01 / %IW04	B _L A	–	–	• / –	
09	%IX0.02 / %IW05	B _L A	–	–	• / –	
28	%IX0.03 / %IW06	B _L A	–	–	• / –	
10	%IX0.04 / %IW07	B _L A	–	–	• / –	
29	%IX0.05 / %IW08	B _L A	–	–	• / –	
11	%IX0.06 / %IW09	B _L A	–	–	• / –	
30	%IX0.07 / %IW10	B _L A	–	–	• / –	
44	%IX0.08	B _L	%QX0.00	B _H PWM PWM _L	– / •	VBB _n (1)
45	%IX0.09	B _L	%QX0.01	B _H PWM PWM _L	– / •	VBB _n (1)
46	%IX0.10	B _L	%QX0.02	B _H PWM PWM _L	– / •	VBB _n (1)
47	%IX0.11	B _L	%QX0.03	B _H PWM PWM _L	– / •	VBB _n (1)
20	%IX0.12	B _L I _L	(FRQ 0) –	–	• / –	
02	%IX0.13	B _L I _L	(FRQ 1) –	–	• / –	
21	%IX0.14	B _L I _L	(FRQ 2) –	–	• / –	
38	%IX0.15	B _L I _L	(FRQ 3) –	–	• / –	
36	%IX1.00	B _L	%QX0.04	B _H PWM PWM _L	– / •	VBB _n (2)
54	%IX1.01	B _L	%QX0.05	B _H PWM PWM _L	– / •	VBB _n (2)
17	%IX1.02	B _L	%QX0.06	B _H PWM PWM _L	– / •	VBB _n (2)
53	%IX1.03	B _L	%QX0.07	B _H PWM PWM _L	– / •	VBB _n (2)
19	%IX1.04	B _{L,H} I _L	(CYL 0) –	–	• / –	
55	%IX1.05	B _{L,H} I _L	(CYL 1) –	–	• / –	
18	%IX1.06	B _{L,H} I _L	(CYL 2) –	–	• / –	
37	%IX1.07	B _{L,H} I _L	(CYL 3) –	–	• / –	
39	%IX1.08	B _{L,H}	%QX0.08	B _H	• / •	VBB _n (1)
03	%IX1.09	B _{L,H}	%QX0.09	B _H	• / •	VBB _n (1)
40	%IX1.10	B _{L,H}	%QX0.10	B _H	• / •	VBB _n (1)
22	%IX1.11	B _{L,H}	%QX0.11	B _H	• / •	VBB _n (1)
41	%IX1.12	B _{L,H}	%QX0.12	B _H	• / •	VBB _n (1)
42	%IX1.13	B _{L,H}	%QX0.13	B _H	• / •	VBB _n (1)
43	%IX1.14	B _{L,H}	%QX0.14	B _H	• / •	VBB _n (1)
04	%IX1.15	B _{L,H}	%QX0.15	B _H	• / •	VBB _n (1)
48	%IX2.00	B _L	%QX1.00	B _H PWM	• / •	VBB _n (2)
49	%IX2.01	B _L	%QX1.01	B _{H,A} H-Bridge	• / •	VBB _n (2)
31	%IX2.02	B _L	%QX1.02	B _{H,A} H-Bridge	• / •	VBB _n (2)
50	%IX2.03	B _L	%QX1.03	B _H PWM	• / •	VBB _n (2)
51	%IX2.04	B _L	%QX1.04	B _H PWM	• / •	VBB _n (2)
52	%IX2.05	B _L	%QX1.05	B _{H,A} H-Bridge	• / •	VBB _n (2)
16	%IX2.06	B _L	%QX1.06	B _{H,A} H-Bridge	• / •	VBB _n (2)
35	%IX2.07	B _L	%QX1.07	B _H PWM	• / •	VBB _n (2)

Note the double pin connection of inputs/outputs.

*only positive sensor signals with diagnostic capability

Eaton

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