



EtherNet/IP interface

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2 Introduction

2.1 Scope of the document

These instructions are supplementary to the standard FOCUS-1 Manual. They provide additional user information on how to connect the device to a ETHERNET/IP IO network.

2.2 Used abbreviations

DAP	Device Access Point
EDS	Electronic Data Specification: formal description of the behavior of an EtherNet/IP device
EZEDS	(Pronounce: Easy EDS) ODVA provided tool to generate and check and eds file, to conform to its standard.
I&M	Information & Maintenance
I/O	Input Output
PLC	Programmable Logic Controller
RT	Real Time
PID	Proportional Integral Differential controller

2.3 EtherNet/IP general information

EtherNet/IP is an Ethernet based communication protocol. The device connects to a EtherNet/IP scanner via a dedicated Ethernet port.

	FOCUS-1 Device
Conformance Class	CC-B
Basic function	EtherNet/IP - Cyclic data in the form of process values, statuses and alarms - Direct Valve control - Indirect Valve control via - Flow control - Pressure control (inlet or outlet) - Pressure drop control - External sensor input (if applicable)
Cabling	IEC 61784-5-3 Copper
Typical application	Process automation

2.4 Electrical connections

Connections to both Ethernet and EtherNet/IP are done via one M12 Connector located at the back of the device on the electronics cabinet. Both ethernet protocols are communicated via one cable saving on wiring for the customer.

2.5 Physical Connection to ethernet and EtherNet/IP.

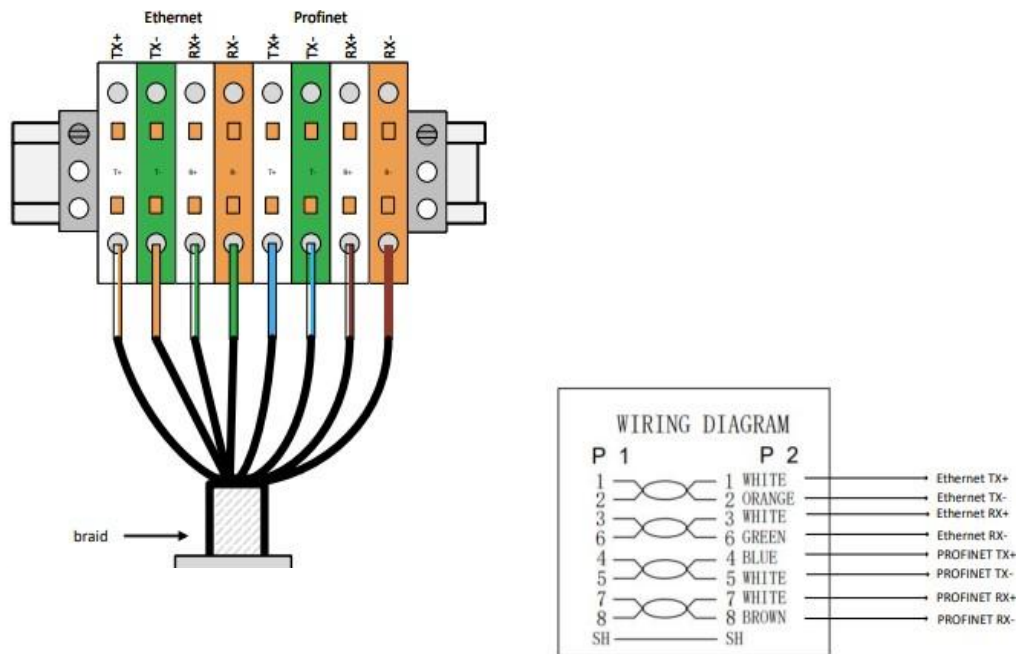
The FOCUS-1 device for EtherNet/IP provides two 4-wire ethernet connections:

- a TCP/IP connection for the dashboard usage (supporting HTTP) and service maintenance (SSH)
- a dedicated TCP connection for EtherNet/IP communication.

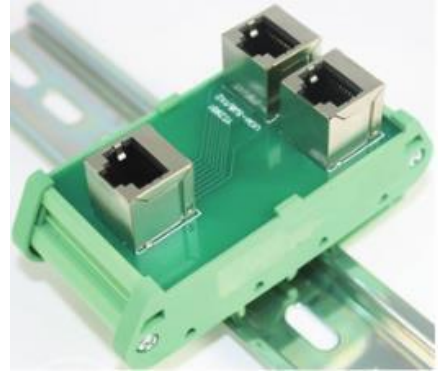
Both connections have their own MAC address and can be assigned separate IP addresses

The FOCUS-1 device is equipped with a single 8 pin female M12 connector, via which both TCP connections are available.

The M12 connector has 8 pins, enough for 2 pairs ethernet and 2 pairs EtherNet/IP. The wires are arranged as follows:



Depending on the hardware selection on customer side, we suggest to use a 8 wire cable like the example below.



To make use of the wired ethernet functionality next to the EtherNet/IP functionality, a so called [ethernet splitter](#) is needed to create a EtherNet/IP and a ethernet J45 connector. This splits the 8 wires so that one RJ45 connector can be used for EtherNet/IP and the other for normal TCP/IP traffic including dashboard access.

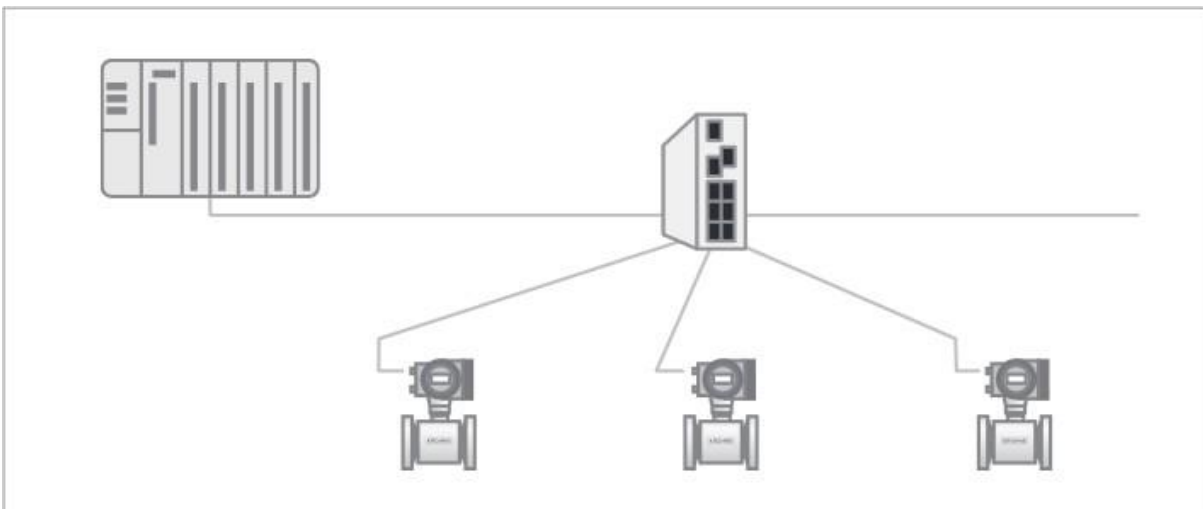


Figure 3-3: Point-to-point or star topology

3 System integration

After physically connecting the EtherNet/IP wires to your EtherNet/IP infrastructure, the Focus-1 device needs to be assigned an IP address. This is typically arranged using the tooling from your PLC vendor.

The EtherNet/IP EDS file is required for system integration. The file contains a device description written in the EDS language (ini-formatted).

The EDS file can be downloaded from the device documentation folder.



See the Quick Start guide for HW_V-4.5 on how to connect to the device and download the EDS file.

Currently, the Focus-1 device supports dynamically one of three EDS files, to be configured on the device. Older versions of the EDS files are available for backward compatibility reasons.

Software release	EDS	Notes
v1.3	EZEDS-V3.31-FocusOn-Focus1-20230503	Initial release
v1.4	EZEDS-V3.31-FocusOn-Focus1-20230915	Added new alarms

It is important to ensure that the configured EDS file in the Focus-1 dashboard matches the EDS file loaded/configured into your PLC.

3.1 Scope

The FOCUS-1 smart control device v1.4.1 complies to EtherNet/IP from ODVA. This document specifies features, concerning the publication of device status, alarms, process values and setpoint settings.

3.2 Who should use this document?

This specification is created to be technical reference for EtherNet/IP capable host application developers, system integrators and knowledgeable end users. This document assumes the reader is familiar with the EtherNet/IP protocol requirements and technology.

3.3 Device identification

Manufacturer Name :	FOCUS-ON V.O.F.	Model Name :	Focus1
Vendor ID code:	1748 (Decimal)	Product Code :	100(decimal)
EZEDS protocol revision:	3.31	Device Revision	1.4

3.4 Product overview

FOCUS-1 is a smart control device. In addition to normal globe valve control, it has the possibility to control flow by a given setpoint in flow. FOCUS-1 has one single button for interacting and configuration of the device. When pressed you can connect to all devices with a working WIFI and/or ethernet connection like a smartphone, tablet or laptop. Please see the datasheet and manual for more information on the device capabilities.

FOCUS-1 has a 4-20mA analog input with HART functionality and a passive analog 4-20mA output. The device is externally powered by 100 - 230 VAC or 18 - 36VDC

Since Focus-1 release v1.2.0, the system has a purchasable EtherNet/IP module for system status, alarms, process values, system settings and setpoint provision.



4 Configuration

Release 1.4.1 of the FOCUS-1 software has the following configuration options

Option	Description
Enable/Disable	For applications based on EtherNet/IP communication this option allows the customer to (temporarily) disable EtherNet/IP and suppress possible alarms concerning EtherNet/IP configuration or communication. ¹
EDS	Release v1.4.1 comes with a new EDS file, but also supports the EDS file from release v1.2.0 / v1.3.1 This option allows the customer to select the active EDS, which must match the one loaded in the PLC.
Setpoint source	FOCUS-1 supports reading of a setpoint from EtherNet/IP. ¹
Setpoint Type	When EtherNet/IP is selected as setpoint source, the system can interpret the EtherNet/IP setpoint as: <ul style="list-style-type: none">- Valve Position Setpoint- Volume Flow Setpoint- Inlet Pressure Setpoint- Outlet Pressure Setpoint- External Sensor Setpoint
Setpoint unit	When EtherNet/IP is selected as a setpoint source, the customer can indicate what the unit is of the setpoint. These units differ per type. Volume Flow: <ul style="list-style-type: none">- m³/day, m³/h, m³/min, m³/s (cubic meters)- l/h, l/min, l/s, (liters)- ft³/h, ft³/min, ft³/s, (cubic feet)- gal/day, gal/h, gal/min, gal/s, (US gallon)- IG/day, IG/h, IG/min, IG/s, (Imperial gallon)- barrel/day, barrel/h Pressure: <ul style="list-style-type: none">- bar,- psi,- Pa, kPa, MPa,- torr,- atm,- mmHg, inHg, (mm or inches of mercury)- mmH₂O, inH₂O (mm or inches of water) Temperature: <ul style="list-style-type: none">- deg. Celsius, deg. Fahrenheit, Kelvin
¹ Options <i>Enable</i> and <i>Setpoint Source</i> have an interdependency: If the <i>Setpoint Source</i> is set to <i>EtherNet/IP</i> , while <i>EtherNet/IP</i> is disabled (<i>Enabled</i> is OFF), then the system will raise an <i>EtherNet/IP Configuration Alarm</i> .	



5 Data module

Unlike other PLC protocols, EtherNet/IP does not support submodules. The data is simply divided in

- Output Assembly
- Setpoint Assembly

As an alternative, the parameters have been grouped:

Group range no.	ID	Description
1xx	Process values	All process values
2xx	System status	Device and Alarm status
3xx	Alarms	Bit fields representing the device alarms
4xx	Setpoints	Information about the current setpoint interpretation (device to controller) and the current setpoint value (controller to device)

5.1 Output Assembly

Param no.	Assembly byte offset	ID	Description	Unit
101	0-3	DeviceValue:x_SSPActValvePosExtRef, unit:%, factor:1, offset:0.0	Actuator Valve Position	% Open
102	4-7	DeviceValue:p4_SSPActDrivingAirPressureExtRef, unit:Pa, factor:1, offset:0.0	Actuator Driving Air Pressure	Pa
103	8-11	DeviceValue:p3_SSPActSupplyAirPressureExtRef, unit:Pa, factor:1, offset:0.0	Actuator Supply Air Pressure	Pa
104	12-15	CalculatedValue:VolumeFlowOPV, unit:, factor:1, offset:0.0	Volume Flow*	m ³ /h
105	16-19	CalculatedValue:Pressure10PV, unit:Pa, factor:1, offset:0.0	Inlet Pressure*	Pa
106	20-23	CalculatedValue:Pressure20PV, unit:Pa, factor:1, offset:0.0	Outlet Pressure*	Pa
107	24-27	CalculatedValue:TemperatureOPV, unit:K, factor:1, offset:0.0	Medium Temperature*	K
108	28-31	DeviceValue:Gain, unit:dB, factor:1, offset:0.0	Flow meter Gain	dB



Param no.	Assembly byte offset	ID	Description	Unit
109	32-35	DeviceValue:SNR, unit:dB, factor:1, offset:0.0	Flow meter Signal/Noise Ratio	dB
110	36-39	DeviceValue:Velocity of Sound, unit:m/s, factor:1, offset:0.0	Velocity of Sound	m/s
111	40-43	DeviceValue:ExternalSensor, unit:, factor:1, offset:0.0	Converted value of the external sensor	-
112	44-47	DeviceValue:Setpoint, unit:, factor:1, offset:0.0	Generic Setpoint (output)	-
113	48-51	DeviceValue:ValvePositionSetpoint, unit:%, factor:1, offset:0.0	Valve Position Setpoint	% Open
201	52	DeviceStatus		
202	53	AlarmStatus		
301	54	DeviceEvent, namur:0, severity:1, category:3		
302	55	DeviceEvent, namur:1, severity:1, category:3		
303	56	DeviceEvent, namur:2, severity:1, category:0		
304	57	DeviceEvent, namur:2, severity:1, category:1		
305	58	DeviceEvent, namur:2, severity:1, category:3		
306	59	DeviceEvent, namur:2, severity:2, category:3		
307	60	DeviceEvent, namur:2, severity:3, category:1		
308	61	DeviceEvent, namur:2, severity:4, category:0		
309	62	DeviceEvent, namur:4, severity:2, category:1		
310	63	DeviceEvent, namur:4, severity:2, category:2		
401	64	Setting, name:SetpointSource, map:1=Analog;3=Dashboard;4=Ethernetip	Source for the setpoint, as a single byte number	-
402	65	Setting, name:ControlTypeldentifier	Type of the setpoint, as a single byte number	-
403	66	Setting, name:UnitTypeldentifier	Unit of the setpoint, as a single byte number	-
404	0	DeviceValue:Setpoint, unit:, factor:1, offset:0.0	Setpoint (input)	-

(*)redundant regarding sensor failure: These values will be based on multiple sensor inputs. If one of the sensors fails, the other sensors fill in dynamically, at a lower precision.

E.g. Pressure2 (outlet pressure) can be measured by the sensor, or computed from inlet sensor, flow sensor and valve position in case of sensor failure.



E.g. Temperature can be measured by the upstream Inlet temperature sensor. If that sensor fails, the Temperature is computed from the downstream Outlet temperature sensor

Focus-1 supports interpretation of the analog IN as an external sensor value, in case the setpoint is acquired from an alternative source (i.e. dashboard, EtherNet/IP).

This external sensor value (as incoming 4..20 mA signal) must be mapped to an alternative range, and must be used for control purposes: the setpoint applies to the external sensor actual value. There is no formal unit assigned to this range, as the external sensor can measure any value and scale it to the 4..20 mA range, as configured in the Focus1 dashboard. For display reasons, the unit can be specified and can be entered, but this unit is not conveyed over EtherNet/IP.

This mapped value is conveyed in the External Sensor submodule, or is 0 (zero) when not applicable. The configuration of the external sensor feature is available for specific applications. It is highly recommended to consult Focus On Service & Consultancy before implementing this application.

5.2 Params Group 2xx : Status information

Submodule byte offset	ID	Description
0	DeviceStatus	Single byte status, indicating the operator setting: 0 = Unknown 1 = Operational 2 = Maintenance 3 = Safety
1	AlarmStatus	0 = OK 1 = Maintenance required 2 = Out-of-spec 3 = Function Check ² 4 = Failure ³



5.3 Params Group 3xx: Alarms

The Alarms submodule consists of 10 bytes, each byte representing a group of alarms:

Submodule byte offset	ID	Description
0	DeviceEvent, namur:0, severity:1, category:3	Device Alarm, namur:OK, severity:High, category:Device-indicative
1	DeviceEvent, namur:1, severity:1, category:3	Device Alarm, namur:Maintenance-required, severity:High, category:Device-indicative
2	DeviceEvent, namur:2, severity:1, category:0	Device Alarm, namur:Out-of-spec, severity:High, category:Process-critical
3	DeviceEvent, namur:2, severity:1, category:1	Device Alarm, namur:Out-of-spec, severity:High, category:Process-indicative
4	DeviceEvent, namur:2, severity:1, category:3	Device Alarm, namur:Out-of-spec, severity:High, category:Device-indicative
5	DeviceEvent, namur:2, severity:2, category:3	Device Alarm, namur:Out-of-spec, severity:Medium, category:Device-indicative
6	DeviceEvent, namur:2, severity:3, category:1	Device Alarm, namur:Out-of-spec, severity:Low, category:Process-indicative
7	DeviceEvent, namur:2, severity:4, category:0	Device Alarm, namur:Out-of-spec, severity:Warning, category:Process-critical
8	DeviceEvent, namur:4, severity:2, category:1	Device Alarm, namur:Failure, severity:Medium, category:Process-indicative
9	DeviceEvent, namur:4, severity:2, category:2	Device Alarm, namur:Failure, severity:Medium, category:Device-critical

² In case DeviceStatus equals 2 (Maintenance), then AlarmStatus is automatically set to 3 (Function Check)
³ In case DeviceStatus equals 3 (Safety), then AlarmStatus is automatically set to 4 (Failure)

Within these 10 groups, the following alarms have been defined:

Name	Param no.	Bit offset	Description
FalseMediumSettings	301	0	Medium Settings are not filled in correctly.
PositionerStatusMaintenance	302	0	Positioner NAMUR status is Maintenance required.
SensorFailure2	302	1	Two or more sensors are failing. The device is still able to control with the current settings. Please plan maintenance as soon as possible.
SetpointDeviation	303	0	Current process value deviates too much from setpoint. Consider the autotuning function and check the process conditions.
EmptyPipe	304	0	No medium detected. Process pipe is empty or containing a severe amount of gas flow.



Name	Param no.	Bit offset	Description
FlowSensorFailure	305	0	The ultrasonic flow measurement is failing. Flow value is calculated based on the pressure sensor and valve position information. Device specifications can no longer be guaranteed. Please plan short term maintenance.
PressureSensor1Failure	305	1	The upstream pressure sensor is failing. The pressure value is calculated based on flow measurement, valve position and the downstream pressure sensor. Device specifications can no longer be guaranteed. Please plan a short term maintenance.
PressureSensor2Failure	305	2	The downstream pressure sensor is failing. The pressure value is calculated based on flow measurement, valve position and the upstream pressure sensor. Device specifications can no longer be guaranteed. Please plan a short term maintenance.
InternalLeakage	306	0	Possible Internal Leakage. Please plan long term maintenance.
PositionerStatusOutOfSpec	306	1	Positioner NAMUR status is Out of Specification.
Cavitation	307	0	Severe level of cavitation present in the valve. Cavitation may negatively affect the flow measurement. Device specifications can no longer be guaranteed. Cavitation causes wear to the valves body and plug/seat. This will decrease the lifetime of the device. Possible ways to preclude cavitation: increase pressure, decrease flow speed.
Flashing	307	1	Severe level of flashing present in the valve. Flashing may negatively affect the flow measurement. Device specifications can no longer be guaranteed. Flashing also causes wear to the valve body and plug/seat. This will decrease the lifetime of the device. Possible ways to preclude flashing are: increasing pressure, decreasing flow speed.
AmbientTemperatureTooHigh	308	0	Ambient temperature is exceeding maximum limit. Life time of electronics will be strongly affected. Device specifications are no longer guaranteed. Try to reduce the ambient temperature.
AmbientTemperatureTooLow	308	1	Ambient temperature is exceeding minimum limit. Life time of electronics will be strongly affected. Device specifications are no longer guaranteed. Try to increase the ambient temperature.
AirPressureTooHigh	308	2	Air pressure is exceeding maximum limit. Too high air pressure results in a higher change of broken springs or ruptured membrane in the actuator. Try to decrease the supply air pressure.



Name	Param no.	Bit offset	Description
AirPressureTooLow	308	3	Air pressure is below the minimum limit. Controllability of the device is becoming at risk. Try to increase supply air pressure. Device specifications are no longer guaranteed.
MediumTemperatureTooHigh	308	4	Medium temperature is exceeding maximum limit. Try to decrease the medium temperature. Device specifications can no longer be guaranteed. Lifetime of the device is strongly affected.
MediumTemperatureTooLow	308	5	Medium temperature is below the minimum limit. Try to increase the medium temperature. Device specifications can no longer be guaranteed. Lifetime of the device is strongly affected. Try to increase the medium temperature. Device specifications can no longer be guaranteed. Lifetime of the device is strongly affected.
PressureTooHigh	308	6	Pressure is exceeding the maximum limit. Try to decrease the pressure. Device specifications can no longer be guaranteed. Lifetime of the device is strongly affected.
FalseMediumSettingsFailure	309	0	Medium Settings are not filled in correctly. This leads to incorrect process values.
AirPressureLoss	310	0	No supply air pressure available. No control possible. Device is in safety position. Check air supply.
AnalogInputError	310	1	No DCS Input connected to the device. No control possible. The device is in safety position. Please check DCS input or plan maintenance as soon as possible.
PositionerError	310	2	Connection Lost with the positioner. No communication possible with the positioner. Device is in safety position. Please plan maintenance as soon as possible.
PositionerStatusFailure	310	3	Positioner NAMUR status is Failure.
SensorFailure	310	4	Two or more sensors are failing. The device is not able control with the current settings. The device is still able to control on valve position. Please plan maintenance as soon as possible.
FirmwareFailure	310	5	System firmware is not fully operational. A power cycle operation may be needed. Please plan maintenance.

5.4 Params group 4xx: Setpoint Process and Setting Values

The Type of setpoint can be configured in the Focus1 dashboard and currently offer the options as listed below. Each of the options has a single byte identifier as defined in the HART-7 standard. This identifier is conveyed in this Profinet submodule.



Setpoint Control type	Identifier (decimal)
Valve Position	244
VolumeFlow	72
Inlet Pressure	113
Outlet Pressure	65
Delta Pressure	112
External sensor	111

The Unit of the setpoint can be configured in the Focus1 dashboard and currently offer the options as listed below. The unit options are different for each type. Each of the options has a single byte identifier as defined in the HART-7 standard. This identifier is conveyed in this Profinet submodule.

Setpoint Control type	Available units	Unit identifier (decimal)
Valve Position	%	244
VolumeFlow	m3/h	19
	ft3/min	15
	gal/min	16
	l/s	24
	m3/day	29
	m3/min	131
	m3/s	28
	l/h	138
	l/min	17
	ft3/h	130
	ft3/s	26
	gal/day	235
	gal/h	136
	gal/s	22
	IG/day	31
	IG/h	30
	IG/min	18
IG/s	137	
barrel/day	135	
barrel/h	134	
Inlet Pressure Outlet Pressure Delta Pressure	Pa	11
	kPa	12
	MPa	237
	bar	7
	psi	6
	torr	13
	atm	14
External sensor		252