System integration
Modbus TCP – documentation

1 Integration with Modbus TCP

Modbus TCP is available on the Ethernet port only with prior activation.

(For activation via the operating panel follow the steps shown below)

Activation via RS-232 serial communication: using command ETH MODBUS ON [‹Port›]. Modbus can be deactivated by entering ETH MODBUS OFF. Please refer to chapter 2 for detailed information on serial communication.

CAUTION: this mode opens an unsecure port into the network and thus requires a secure local network with firewall, to avoid risk of attacks on the EFOY.

Requirements:

- The default TCP port is 502, but configurable via RS-232 communication at ETH command.
- The byte ordering for a 16-bit word is Big-endian. The word order is Little-endian for all 32bit/64bit values.
- The EFOY accepts up to eight concurrent TCP connections from the local subnet (defined by IPv4 Mask via DHCP or via ETH command).
- The MODBUS TCP client must support TCP Keep-Alive (every 15 minutes).
- The input registers and discrete inputs are updated with 1Hz at maximum. (Therefore, higher polling rates are useless).
- Coil values are OFF by default. To apply the function, set the coil to ON. The EFOY will clear the coil on execution starting.
- Holding register values are -1 for integer and NAN for floats by default. To apply a new value, set the input register to the new value. The EFOY will clear the value on successfully altering the underlying preference.

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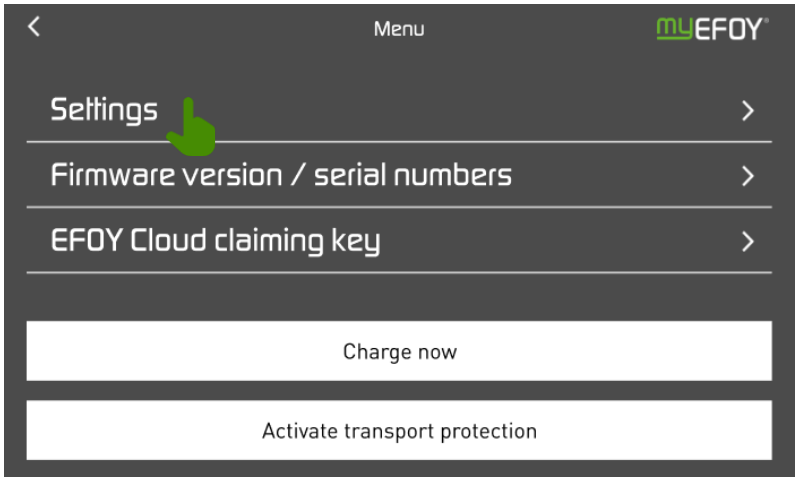
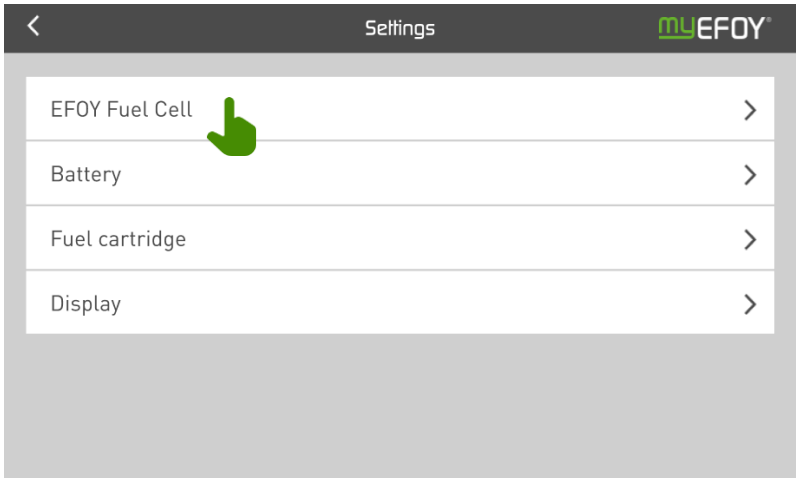
Activation of the Modbus TCP via operating panel:

- Go to Menu and select ‹‹Settings››



- Then go to ‹‹EFOY Fuel Cell››



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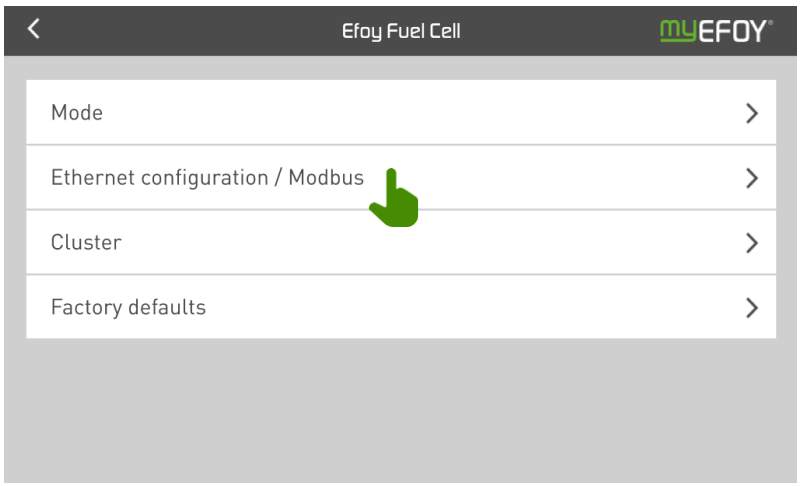
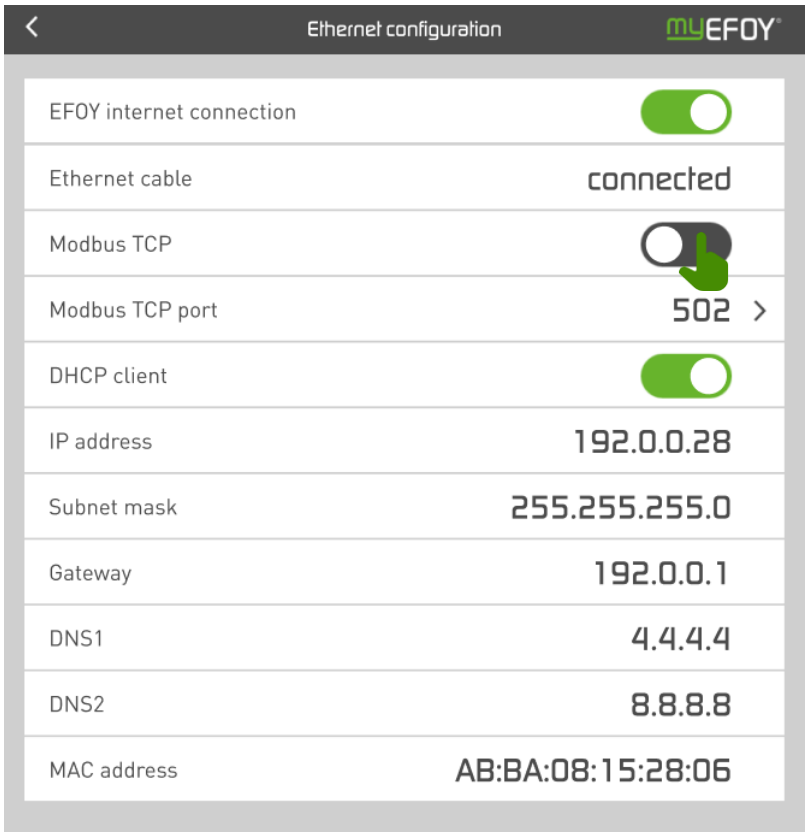
- Select ‹‹Ethernet configuration / Modbus››



- To activate the Modbus TCP functions you have to press the ‹‹Modbus TCP switch››
- Modbus TCP port is by default set to 502



- Your Modbus TCP is now activated

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Green marked registers are implemented with the EFOY firmware 24.15.303

1.1 Discrete Inputs (read)

Name	Type	Address	Description
LogSystemOffOk	bit	10001	Indicates whether the system can be turned off manually
LogSystemOnOk	bit	10002	Indicates whether the system can be turned on manually
CurrentErrorActive	bit	10003	A critical problem will prevent the fuel cell from operating correctly. Immediate maintenance is required for continued operation.
CurrentWarningActive	bit	10004	Whether any warning is active. A warning indicates that maintenance should be done on the system soon.
NewBatConfigBad	bit	10005	Whether the new configuration as entered by the user is invalid
fuelBelow75	bit	10009	Remaining fuel in cartridge or all active FM (Fuel Manager) ports is less than 75%
fuelBelow50	bit	10010	Remaining fuel in cartridge or all active FM ports is less than 50%
fuelBelow40	bit	10011	Remaining fuel in cartridge or all active FM ports is less than 40%
fuelBelow30	bit	10012	Remaining fuel in cartridge or all active FM ports is less than 30%
fuelBelow25	bit	10013	Remaining fuel in cartridge or all active FM ports is less than 25%
fuelBelow20	bit	10014	Remaining fuel in cartridge or all active FM ports is less than 20%
fuelBelow15	bit	10015	Remaining fuel in cartridge or all active FM ports is less than 15%
fuelBelow10	bit	10016	Remaining fuel in cartridge or all active FM ports is less than 10%
fuelBelow5	bit	10017	Remaining fuel in cartridge or all active FM ports is less than 5%
FmdPort1EnabledStatus	bit	10021	Fuel Manager (FM) port 1 enabled
FmdPort2EnabledStatus	bit	10022	FM port 2 enabled
FmdPort3EnabledStatus	bit	10023	FM port 3 enabled
FmdPort4EnabledStatus	bit	10024	FM port 4 enabled

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FmdPort5EnabledStatus	bit	10025	FM port 5 enabled
FmdPort6EnabledStatus	bit	10026	FM port 6 enabled
FmdPort7EnabledStatus	bit	10027	FM port 7 enabled
FmdPort8EnabledStatus	bit	10028	FM port 8 enabled
FmdPort1ActiveStatus	bit	10029	FM port 1 active
FmdPort2ActiveStatus	bit	10030	FM port 2 active
FmdPort3ActiveStatus	bit	10031	FM port 3 active
FmdPort4ActiveStatus	bit	10032	FM port 4 active
FmdPort5ActiveStatus	bit	10033	FM port 5 active
FmdPort6ActiveStatus	bit	10034	FM port 6 active
FmdPort7ActiveStatus	bit	10035	FM port 7 active
FmdPort8ActiveStatus	bit	10036	FM port 8 active
FmdFS2Sensor	bit	10037	Current status from the Fmd FS Sensor 1 = Fuel level above sensor or no sensor connected 0 = Fuel level below sensor
MSAvailable	bit	10038	MultiSense is available 0 = no MultiSense connected or not ready for use 1 = MultiSense is connected and it is ready to use
MSTemperature1Enable	bit	10039	MS Temperature 1 is enabled. 0 = disabled 1 = enabled
MSTemperature2Enable	bit	10040	MS temperature 2 is enabled.
MSAnalog1Enable	bit	10041	MS analog 1 is enabled.
MSAnalog2Enable	bit	10042	MS analog 2 is enabled.
MSDio1Enable	bit	10043	MS digital 1 is enabled.
MSDio1Direction	bit	10044	MS digital 1 configured direction 0 = Input 1 = Output
MSDio1Invert	bit	10045	MS digital 1 logic 0 = regular 1 = inverted
MSDio1PowerOn	bit	10046	MS digital 1 logic level after power on
MSDio1EmergencyInUse	bit	10047	MS digital 1 emergency mode is in use 0 = Not used 1 = Used It indicates whether the port will switch to the state defined by the value of MSDio1Emergency in case of an error.
MSDio1Emergency	bit	10048	MS digital 1 logic level after emergency

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MSDio2Enable	bit	10049	MS digital 2 is enabled.
MSDio2Direction	bit	10050	MS digital 2 configured direction 0 = Input 1 = Output
MSDio2Invert	bit	10051	MS digital 2 logic 0 = regular 1 = inverted
MSDio2PowerOn	bit	10052	MS digital 2 logic level after power on
MSDio2EmergencyInUse	bit	10053	MS digital 2 emergency mode is in use 0 = Not used 1 = Used It indicates whether the port will switch to the state defined by the value of MSDio1Emergency in case of an error.
MSDio2Emergency	bit	10054	MS digital 2 logic level after emergency
MSDio3Enable	bit	10055	MS digital 3 is enabled.
MSDio3Direction	bit	10056	MS digital 3 configured direction 0 = Input 1 = Output
MSDio3Invert	bit	10057	MS digital 3 logic 0 = regular 1 = inverted
MSDio3PowerOn	bit	10058	MS digital 3 logic level after power on
MSDio3EmergencyInUse	bit	10059	MS digital 3 emergency mode is in use 0 = Not used 1 = Used It indicates whether the port will switch to the state defined by the value of MSDio1Emergency in case of an error.
MSDio3Emergency	bit	10060	MS digital 3 logic level after emergency
MSDio4Enable	bit	10061	MS digital 4 is enabled.
MSDio4Direction	bit	10062	MS digital 4 configured direction 0 = Input 1 = Output
MSDio4Invert	bit	10063	MS digital 4 logic 0 = regular 1 = inverted
MSDio4PowerOn	bit	10064	MS digital 4 logic level after power on
MSDio4EmergencyInUse	bit	10065	MS digital 4 emergency mode is in use 0 = Not used 1 = Used

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			It indicates whether the port will switch to the state defined by the value of MSDio1Emergency in case of an error.
MSDio4Emergency	bit	10066	MS digital 4 logic level after emergency
MSDio1Value	bit	10067	Current logical value of MS digital 1.
MSDio2Value	bit	10068	Current logical value of MS digital 2.
MSDio3Value	bit	10069	Current logical value of MS digital 3.
MSDio4Value	bit	10070	Current logical value of MS digital 4.

1.2 Input Register (read)

Name	Type	Unit	Address	Description
SystemType	uint32		30001	First part of the serial number
AssemblyDate	uint32		30003	Middle part of the serial number
SequentualNumber	uint32		30005	Last part of the serial number
FirmwareVersionMajor	uint16		30007	Major firmware version
FirmwareVersionMinor	uint16		30008	Minor firmware version
FirmwareRevision	uint32		30009	Firmware revision
RatedOutputPower	uint16	W	30011	The rated output power.
LogPOut	float32	W	30021	Actual power output
LogUBat	float32	V	30023	Battery voltage
LogTAmb	float32	°C	30025	Ambient temperature
LogWOutCum	uint32	Wh	30027	Cumulative power generated by the EFOY
LogBatSoc	int16		30029	State of the charge of the smart battery,
LogSystemOnReason	uint16, enum		30030	Reason the system has turned on (details see chapter 1.6)
LogSystemOffReason	uint16, enum		30031	Reason the system has turned off (details see chapter 1.6)
CurrentErrorCode	uint16, enum		30032	The actual error code (Major) when ErrorActive is set, 0 otherwise.
CurrentErrorCodeMinor	uint16, enum		30033	Minor value of error code
LastErrorCode	uint16, enum		30034	The previously set error code.
LastErrorCodeMinor	uint16, enum		30035	Minor value of error code
CurrentWarningCode	uint16,		30036	The actual warning code when

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	enum			WarningActive is set, 0 otherwise.
CurrentWarningCodeMinor	uint16, enum		30037	Minor value of warning code
LastWarningCode	uint16, enum		30038	The previously set warning code.
LastWarningCodeMinor	uint16, enum		30039	Minor value of warning code
SystemState	uint16, enum		30040	Current EFOY state (for details, see chapter 1.5)
OperatingMode	uint16, enum		30041	Current EFOY operating mode (for details, see chapter 1.5)
CMAutoAvg	uint32	sec	30051	Average cycle duration of automatic cycles
CMAutoLast	uint32	sec	30053	Last automatic cycle duration
CMAutoCum	uint32	sec	30055	Total duration of all automatic cycles.
CMAutoCnt	uint32	sec	30057	Total number of automatic cycles
CMManAvg	uint32	sec	30059	Average cycle duration of manual cycles
CMManLast	uint32	sec	30061	Last manual cycle duration
CMManCum	uint32	sec	30063	Total duration of all manual cycles.
CMManCnt	uint32	sec	30065	Total number of manual cycles
CMDDPAvg	uint32	sec	30067	Average cycle duration in deep discharge protection mode
CMDDPLast	uint32	sec	30069	Last deep discharge protection cycle duration
CMDDPCum	uint32	sec	30071	Total duration of all deep discharge protection cycles.
CMDDPCnt	uint32	sec	30073	Total number of cycles in deep discharge protection mode
CMFPAvg	uint32	sec	30075	Average cycle duration in frost protection mode
CMFPLast	uint32	sec	30077	Last frost protection cycle duration
CMFPCum	uint32	sec	30079	Total duration of all frost protection cycles.
CMFPCnt	uint32	sec	30081	Total number of cycles in frost protection mode
CMErrAvg	uint32	sec	30083	Average duration of cycles aborted by an error
CMErrLast	uint32	sec	30085	Last duration of a cycle aborted by an

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				error
CMErrCum	uint32	sec	30087	Total duration of all cycles aborted by an error.
CMErrCnt	uint32	sec	30089	Total number of cycles aborted by an error
CMRstAvg	uint32	sec	30091	Average duration of cycles aborted by a system reset
CMRstLast	uint32	sec	30093	Last duration of a cycle aborted by a system reset
CMRstCum	uint32	sec	30095	Total duration of all cycles aborted by a system reset.
CMRstCnt	uint32	sec	30097	Total number of cycles aborted by a system reset
BatIdStatus	uint16, enum		30101	The current battery type (see chapter 1.7)
BatBocStatus	float32	V	30103	Current begin of charge voltage (= switch on voltage)
BatBocMin	float32	V	30105	Minimum configurable begin of charge voltage
BatBocMax	float32	V	30107	Maximum configurable begin of charge voltage
BatBocDef	float32	V	30109	Default begin of charge voltage
BatEocStatus	float32	V	30111	Current end of charge voltage (= switch off voltage)
BatEocMin	float32	V	30113	Minimum configurable end of charge voltage
BatEocMax	float32	V	30115	Maximum configurable end of charge voltage
BatEocDef	float32	V	30117	Default end of charge voltage
BatCocStatus	float32	A	30119	Current cut-off current (Switch-off current)
BatCocMin	float32	A	30121	Minimum configurable cut-off current
BatCocMax	float32	A	30123	Maximum configurable cut-off current
BatCocDef	float32	A	30125	Default begin cut-off current
BatCapStatus	float32	Ah	30127	Current battery capacity
BatCapMin	float32	Ah	30129	Minimum configurable battery capacity
BatCapMax	float32	Ah	30131	Maximum configurable battery capacity
BatCapDef	float32	Ah	30133	Default battery capacity

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BatCotStatus	float32	min	30135	Current cut off ime (switch-off time)
BatCotMin	float32	min	30137	Minimum configurable switch-off time
BatCotMax	float32	min	30139	Maximum configurable switch-off time
BatCotDef	float32	min	30141	Default switch-off time
BatMaxCtStatus	float32	h	30143	Current maximum charge time
BatMaxCtMin	float32	h	30145	Minimum configurable max. charge time
BatMaxCtMax	float32	h	30147	Maximum configurable max. charge time
BatMaxCtDef	float32	h	30149	Default max. charge time
BatMinCtStatus	float32	min	30151	Current minimum charge time
BatMinCtMin	float32	min	30153	Minimum configurable min. charge time
BatMinCtMax	float32	min	30155	Maximum configurable min. charge time
BatMinCtDef	float32	min	30157	Default min. charge time
BatSodStatus	float32	sec	30159	Current switch on delay
BatSodMin	float32	sec	30161	Minimum configurable switch-on delay
BatSodMax	float32	sec	30163	Maximum configurable switch-off delay
BatSodDef	float32	sec	30165	Default switch-off delay
BatDdpStatus	float32	V	30167	Current deep discharge protection voltage
BatDdpMin	float32	V	30169	Minimum configurable deep discharge protection voltage
BatDdpMax	float32	V	30171	Maximum configurable deep discharge protection voltage
BatDdpDef	float32	V	30173	Default deep discharge protection
BatMaxSocStatus	float32	%	30175	Current maximum state of charge
BatMaxSocMin	float32	%	30177	Minimum configurable state of charge
BatMaxSocMax	float32	%	30179	Maximum configurable state of charge
BatMaxSocDef	float32	%	30181	Default state of charge
BatMaxDodStatus	float32	%	30183	Current maximum depth of discharge
BatMaxDodMin	float32	%	30185	Minimum configurable depth of discharge
BatMaxDodMax	float32	%	30187	Maximum configurable depth of discharge
BatMaxDodDef	float32	%	30189	Default depth of discharge
BatDdpSocStatus	float32	%	30191	Current SOC at which deep discharge protection for smart batteries becomes active
BatDdpSocMin	float32	%	30193	Minimum configurable deep discharge protection SOC
BatDdpSocMax	float32	%	30195	Maximum configurable deep discharge

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				protection SOC
BatDdpSocDef	float32	%	30197	Default deep discharge protection SOC
CartCurTypeStatus	uint16, enum		30201	The current cartridge type (see chapter 1.8)
CartCapStatus	float32	l	30203	Capacity of the current cartridge.
CartRlVolStatus	float32	%	30205	Remaining relative volume in the currently configured cartridge
CartAbVolStatus	float32	l	30207	Remaining absolute volume in the fuel cartridge
FmdNumPort	uint16		30221	Number of Ports (2,4 or 8)
FmdPort1TypeStatus	uint16, enum		30222	FM port 1 actual cartridge type (see chapter 1.8)
FmdPort2TypeStatus	uint16, enum		30223	FM port 2 actual cartridge type (see chapter 1.8)
FmdPort3TypeStatus	uint16, enum		30224	FM port 3 actual cartridge type (see chapter 1.8)
FmdPort4TypeStatus	uint16, enum		30225	FM port 4 actual cartridge type(see chapter 1.8)
FmdPort5TypeStatus	uint16, enum		30226	FM port 5 actual cartridge type (see chapter 1.8)
FmdPort6TypeStatus	uint16, enum		30227	FM port 6 actual cartridge type (see chapter 1.8)
FmdPort7TypeStatus	uint16, enum		30228	FM port 7 actual cartridge type (see chapter 1.8)
FmdPort8TypeStatus	uint16, enum		30229	FM port 8 actual cartridge type (see chapter 1.8)
FmdActivePortNum	uint16		30230	The number of the active port
FmdPort1RlVolStatus	float32	%	30231	FM port 1 remaining relative vol
FmdPort2RlVolStatus	float32	%	30233	FM port 2 remaining relative vol
FmdPort3RlVolStatus	float32	%	30235	FM port 3 remaining relative vol
FmdPort4RlVolStatus	float32	%	30237	FM port 4 remaining relative vol
FmdPort5RlVolStatus	float32	%	30239	FM port 5 remaining relative vol
FmdPort6RlVolStatus	float32	%	30241	FM port 6 remaining relative vol
FmdPort7RlVolStatus	float32	%	30243	FM port 7 remaining relative vol
FmdPort8RlVolStatus	float32	%	30245	FM port 8 remaining relative vol
FmdPort1CapStatus	float32	l	30247	FM port 1 capacity of the current cartridge

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FmdPort2CapStatus	float32	l	30249	FM port 2 capacity of the current cartridge
FmdPort3CapStatus	float32	l	30251	FM port 3 capacity of the current cartridge
FmdPort4CapStatus	float32	l	30253	FM port 4 capacity of the current cartridge
FmdPort5CapStatus	float32	l	30255	FM port 5 capacity of the current cartridge
FmdPort6CapStatus	float32	l	30257	FM port 6 capacity of the current cartridge
FmdPort7CapStatus	float32	l	30259	FM port 7 capacity of the current cartridge
FmdPort8CapStatus	float32	l	30261	FM port 8 capacity of the current cartridge
FmdErrorMajor	uint16		30263	The actual error code major when a Fmd Error is set, 0 otherwise.
FmdErrorMinor	uint16		30264	The actual error code minor when a Fmd Error is set, 0 otherwise.
FmdLastErrorMajor	uint16		30265	The previously set Fmd error code.
FmdLastErrorMinor	uint16		30266	The previously set Fmd error code mi-nor.
LogStackOpTime	float32	h	30271	Stack Operating Time in hours
LogIOut	float32	A	30273	Output Current in A
LogUOut	float32	V	30275	Output Voltage in V
LogMeOHTotal	float 32	l	30277	Total dosed methanol in liter
ClusterRole	**uint16, enum**		**30279**	**Cluster Role**
ClusterOpMode	uint16, enum		30280	Currently active cluster operation mode
ClusterClientCnt	unit16		30281	Total number of cluster clients con-nected to the cluster controller
ClusterControllerIP	unit32		30282	Currently configured IP of the cluster controller
ClusterControllerPin	unit32		30284	The cluster controller pin, if 0 then there is no pin.
ClusterClientPin	unit32		30286	Currently configured client pin, if 0 then there is no pin configured.
LogTStack	float32	°C	30288	Stack temperature.
LogTHE	float32	°C	30290	Heat exchanger temperature.
LogTMeOH	float32	°C	30292	Methanol temperature.
LogpDifComp	float32	hPa	30294	Compensated differential pressure. The zero point offset is taken into consideration.
LogpAmb	float32	hPa	30296	Ambient pressure.

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LogRH	float32	%	30298	Relative humidity.
LogFL	float32	%	30300	Fill level of the fluid in the internal system (intermediate tank + tubes).
LogDSV	float32	µl	30302	Internal value
LogFilltimeTotal	float32	sec	30304	Internal value
LogSysOpTime	float32	h	30306	System operating time (hours the system is connected to a battery).
LogSystemStarts	uint32		30308	Number of system starts.
LogStackStarts	uint32		30310	Number of stack starts.
LogDmfcState	uint16, enum		30312	Internal value
LogDmfcPhase	uint16, enum		30313	Operation phase of the DMFC (0 = idle, 1 = start phase, 2 = charging).
LogStackState	uint16, enum		30314	Internal value
LogStackOcvState	uint16, enum		30315	Internal value
LogStackCtrl	uint16, enum		30316	Internal value
LogHTState	uint16, enum		30317	Internal value
LogTStackMin	float32	°C	30318	Minimum stack temperature.
LogTStackMax	float32	°C	30320	Maximum stack temperature.
LogActiveErrors	uint16		30322	Number of currently active errors.
LogActiveWarnings	uint16		30323	Number of currently active warnings.
LogTStackMinTime	int32		30324	Minimum stack temperature time stamp (UNIX time stamp)*.
LogTStackMaxTime	int32		30326	Maximum stack temperature time stamp (UNIX time stamp)*.
LogErrorTime	int32		30328	RTC date and time when the currently active error was set (UNIX time stamp)*.
LogLastErrorTime	int32		30330	RTC date and time when the previ-ously active error was set (UNIX time stamp)*.
LogWarningTime	int32		30332	RTC date and time when the currently active warning was set (UNIX time stamp)*.
LogLastWarningTime	int32		30334	RTC date and time when the previ-ously

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			active warning was set (UNIX time stamp)*.
LogSystemTime	int32	30336	System time (UNIX time stamp)*.
MSVariant	uint16, enum	30338	The connected MultiSense variant. 0 = Unknown or No MultiSense 1 = MultiSense MS4 2 = MultiSense MS8
MSTemperature1Label	uint16, enum	30339	Current configured label of tempera-ture 1. 0 = Not configured 1 = Custom 2 = Battery 3 = Ambient 4 = Outdoor 5 = Indoor 5 = Cartridge
MSTemperature2Label	uint16, enum	30340	Current configured label of tempera-ture 2. See MSTemperature1Label.
MSAnalog1Label	uint16, enum	30341	Current configured label of analog 1. 0 = Not configured 1 = Custom 2 = Solar 3 = Battery 4 = Load 5 = EFOY
MSAnalog1Sensor	uint16, enum	30342	Current configured sensor of analog 1. 0 = Custom 1 = Current sensor 150A 2 = Current sensor 50A 3 = Current sensor 10A
MSAnalog1Unit	uint16, enum	30343	Current configured unit of analog 1. Volt: Directly measured at the analog input. Ampere: Measured voltage is converted to ampere, depending on the configured sensor type. Watt: Power is computed from battery volt-age and measured current, depending on the configured sensor type. 0 = V 1 = A 2 = W

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MSAnalog2Label	uint16, enum		30344	Current configured label of analog 2. See MSAnalog1Label
MSAnalog2Sensor	uint16, enum		30345	Current configured sensor of analog 2. See MSAnalog1Sensor
MSAnalog2Unit	uint16, enum		30346	Current configured unit of analog 2. See MSAnalog1Unit
MSDio1Label	uint16, enum		30347	Current configured label of digital 1. 0 = Not configured 1 = Custom 2 = Door 3 = EFOY fuel sensor 4 = Fan 5 = Light 6 = Relay
MSDio1Current	uint16, enum	mA	30348	Maximum configured output current of digital port 1.
MSDio2Label	uint16, enum		30349	Maximum configured output current of digital port 2.
MSDio2Current	uint16, enum	mA	30350	Current configured label of digital 4. See MSDio1Label
MSDio3Label	uint16, enum		30351	Current configured label of digital 3. See MSDio1Label
MSDio3Current	uint16, enum	mA	30352	Maximum configured output current of digital port 3.
MSDio4Label	uint16, enum		30353	Current configured label of digital 4. See MSDio1Label
MSDio4Current	uint16, enum	mA	30354	Maximum configured output current of digital port 4.
MSTemperature1Value	float32	°C	30355	Current value of MS temperature 1.
MSTemperature2Value	float32	°C	30357	Current value of MS temperature 2.
MSAnalog1Value	float32		30359	Current value of MS analog 1, the unit is given by the associated register MSAnalog1Unit.
MSAnalog2Value	float32		30361	Current value of MS analog 2, the unit is given by the associated register MSAnalog2Unit.
MSUSupply	float32	V	30363	Current value of MS supply voltage in V.
MSGeneralErrorMajor	uint16		30365	Major number of the current MS general error code.
MSGeneralErrorMinor	uint16		30366	Minor number of the current MS general error code.

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MSGeneralWarningMajor	uint16	30367	Major number of the current MS general warning code.
MSGeneralWarningMinor	uint16	30368	Minor number of the current MS general warning code.
MSTemperature1ErrorMajor	uint16	30369	Major number of the current MS temperature port 1 error code.
MSTemperature1ErrorMinor	uint16	30370	Minor number of the current MS temperature port 1 error code.
MSTemperature2ErrorMajor	uint16	30371	Major number of the current MS temperature port 2 error code.
MSTemperature2ErrorMinor	uint16	30372	Minor number of the current MS temperature port 2 error code.
MSAnalog1ErrorMajor	uint16	30373	Major number of the current MS analog port 1 error code.
MSAnalog1ErrorMinor	uint16	30374	Minor number of the current MS analog port 1 error code.
MSAnalog2ErrorMajor	uint16	30375	Major number of the current MS analog port 2 error code.
MSAnalog2ErrorMinor	uint16	30376	Minor number of the current MS analog port 2 error code.
MSDio1ErrorMajor	uint16	30377	Major number of the current MS digital port 1 error code.
MSDio1ErrorMinor	uint16	30378	Minor number of the current MS digital port 1 error code.
MSDio2ErrorMajor	uint16	30379	Major number of the current MS digital port 2 error code.
MSDio2ErrorMinor	uint16	30380	Minor number of the current MS digital port 2 error code.
MSDio3ErrorMajor	uint16	30381	Major number of the current MS digital port 3 error code.
MSDio3ErrorMinor	uint16	30382	Minor number of the current MS digital port 3 error code.
MSDio4ErrorMajor	uint16	30383	Major number of the current MS digital port 4 error code.
MSDio4ErrorMinor	uint16	30384	Minor number of the current MS digital port 4 error code.

*UNIX time stamp are set to “0” (01.January 1970 00:00:00), if no valid time stamp is available.

1.3 Coil (write)

Name	Type	Address	Description
SystemOn	bit	1	Turn the EFOY on manually.
SystemOff	bit	2	Turn the EFOY off manually
SystemAuto	bit	3	Let the EFOY decide when to turn itself on and off

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			automatically.
SystemReset	bit	4	Reset any warnings and errors, clear the warning and error registers.
BatDefaultConfig	bit	5	Reset Battery Config to default
CartVolReset	bit	6	Reset cartridge level to 100%
ResetCycleMonitor	bit	9	Reset all cycle monitoring units. The values average duration, last duration and count are set to zero. The cumulated cycle durations are not reset. Causes battery degraded error to be reset.
ResetAutoCm	bit	10	Reset the automatic charge cycle monitoring unit. The values average duration, last duration and count are set to zero. The cumulated cycle duration is not reset. Causes battery degraded error to be reset.
ResetManCm	bit	11	Reset the manual charge cycle monitoring unit. The values average duration, last duration and count are set to zero. The cumulated cycle duration is not reset.
FmdPort1Enable	bit	21	Enable FM port 1
FmdPort2Enable	bit	22	Enable FM port 2
FmdPort3Enable	bit	23	Enable FM port 3
FmdPort4Enable	bit	24	Enable FM port 4
FmdPort5Enable	bit	25	Enable FM port 5
FmdPort6Enable	bit	26	Enable FM port 6
FmdPort7Enable	bit	27	Enable FM port 7
FmdPort8Enable	bit	28	Enable FM port 8
FmdPort1Disable	bit	31	Disable FM port 1
FmdPort2Disable	bit	32	Disable FM port 2
FmdPort3Disable	bit	33	Disable FM port 3
FmdPort4Disable	bit	34	Disable FM port 4
FmdPort5Disable	bit	35	Disable FM port 5
FmdPort6Disable	bit	36	Disable FM port 6
FmdPort7Disable	bit	37	Disable FM port 7
FmdPort8Disable	bit	38	Disable FM port 8
UnlockTLP	bit	39	Unlock the system when it is in transport lock mode.
MSDio1OutputHigh	bit	40	Set output value of MS digital port 1 to high
MSDio1OutputLow	bit	41	Set output value of MS digital port 1 to low
MSDio2OutputHigh	bit	42	Set output value of MS digital port 2 to high

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MSDio2OutputLow	bit	43	Set output value of MS digital port 2 to low
MSDio3OutputHigh	bit	44	Set output value of MS digital port 3 to high
MSDio3OutputLow	bit	45	Set output value of MS digital port 3 to low
MSDio4OutputHigh	bit	46	Set output value of MS digital port 4 to high
MSDio4OutputLow	bit	47	Set output value of MS digital port 4 to low

1.4 Holding Register (write)

Name	Type	Unit	Address	Description
BatIdConfig	int16, enum		40001	Configure the battery type (see chapter 1.7)
BatBocConfig	float32	V	40003	New switch-on voltage
BatEocConfig	float32	V	40005	New switch-off voltage
BatCocConfig	float32	A	40007	New switch-off current
BatCapConfig	float32	Ah	40009	New battery capacity
BatCotConfig	float32	min	40011	New switch-off time
BatMaxCtConfig	float32	h	40013	New maximum charge time
BatMinCtConfig	float32	min	40015	New minimum charge time
BatSodConfig	float32	sec	40017	New switch on delay
BatDdpConfig	float32	V	40019	New deep discharge protection voltage
BatMaxSocConfig	float32	%	40021	New maximum state of charge
BatMaxDodConfig	float32	%	40023	New maximum depth of discharge
BatDdpSocConfig	float32	V	40025	New SOC at which deep discharge protection for smart batteries becomes active
CartCurTypeConfig	int16, enum		40031	New fuel cartridge type (see chapter 1.8)
CartCustTypeVolConfig	float32	l	40033	Set the capacity of a custom fuel cartridge
CartRlVolConfig	float32	%	40035	Set the cartridge level to a relative fill level
FmdPort1TypeConfig	int16, enum		40041	FM port 1 new cartridge type (see chapter 1.8)
FmdPort1CapConfig	float32	l	40042	FM port 1 new capacity (custom cartridge type only)
FmdPort1RlVolConfig	float32	%	40044	FM port 1 new relative vol
FmdPort2TypeConfig	int16,		40046	FM port 2 new cartridge type (see

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	enum			chapter 1.8)
FmdPort2CapConfig	float32	l	40047	FM port 2 new capacity (custom cartridge type only)
FmdPort2RlVolConfig	float32	%	40049	FM port 2 new relative vol
FmdPort3TypeConfig	int16, enum		40051	FM port 3 new cartridge type (see chapter 1.8)
FmdPort3CapConfig	float32	l	40052	FM port 3 new capacity (custom cartridge type only)
FmdPort3RlVolConfig	float32	%	40054	FM port 3 new relative vol
FmdPort4TypeConfig	int16, enum		40056	FM port 4 new cartridge type (see chapter 1.8)
FmdPort4CapConfig	float32	l	40057	FM port 4 new capacity (custom cartridge type only)
FmdPort4RlVolConfig	float32	%	40059	FM port 4 new relative vol
FmdPort5TypeConfig	int16, enum		40061	FM port 5 new cartridge type (see chapter 1.8)
FmdPort5CapConfig	float32	l	40062	FM port 5 new capacity (custom cartridge type only)
FmdPort5RlVolConfig	float32	%	40064	FM port 5 new relative vol
FmdPort6TypeConfig	int16, enum		40066	FM port 6 new cartridge type (see chapter 1.8)
FmdPort6CapConfig	float32	l	40067	FM port 6 new capacity (custom cartridge type only)
FmdPort6RlVolConfig	float32	%	40069	FM port 6 new relative vol
FmdPort7TypeConfig	int16, enum		40071	FM port 7 new cartridge type (see chapter 1.8)
FmdPort7CapConfig	float32	l	40072	FM port 7 new capacity (custom cartridge type only)
FmdPort7RlVolConfig	float32	%	40074	FM port 7 new relative vol
FmdPort8TypeConfig	int16, enum		40076	FM port 8 new cartridge type (see chapter 1.8)
FmdPort8CapConfig	float32	l	40077	FM port 8 new capacity (custom cartridge type only)
FmdPort8RlVolConfig	float32	%	40079	FM port 8 new relative vol
ClusterRoleConfig	uint16, enum		40081	Config Cluster Role of the EFOY
ClusterControllerIPConfig	uint32		40082	Config Cluster Controller IP address

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ClusterClientPin	uint32	40084	Config Cluster Client Pin (numeric between 0 and 100'000'000)
FMSelectPortInUse	uint16	40086	Select port in use of the fuel manager (FM2 und FM4)

1.5 SystemState and OperatingMode

SystemState	
0	off
1	standby
2	in operation
3	shut down
4	frost protection
5	deep discharge protection
6	transport lock procedure
7	transport lock
8	reset
9	factory defaults
10	error
11	frost protection
12	pending
13	pending
14	update EFOY accessories

Operating Mode	
0	Automatic
1	off

1.6 SystemOnReason / OffReason

SystemOn

Reason the system has turned on:
0: None
1: System has been turned on manually.
2: The system has turned on automatically because the battery required charging.
3: The system has turned on automatically to enter frost protection mode.
4: The system turned on automatically to enter deep discharge protection mode.

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SystemOff	Reason the system has turned off: 0: None 1: System has been turned off manually. 2: The system turned off automatically because the battery has been fully charged. 3: The system has turned off automatically because the maximum charge time has been reached. 4: The system has turned off automatically because an overvoltage at the output was detected. 5: The system has turned off because frost protection mode has finished. 6: The system has turned off because the fuel cartridge has depleted. 7: The system has turned off because methanol in reservoir and tubes is depleted for transportation mode. 8: The system has turned off because an error has occurred. 9: The system was reset.

1.7 Battery types

Battery types	0: No Battery 1: Lead Acid 12V 2: Lead Acid 24V 3: LiFePO4 12V 4: LiFePO4 24V 5: EFOY Battery

1.8 Cartridge types

Cartridge types	0: unspecified 1: fuel container with custom capacity 2: M5 3: M10 4: M28 5: MT60 6: FM (only register 30201)

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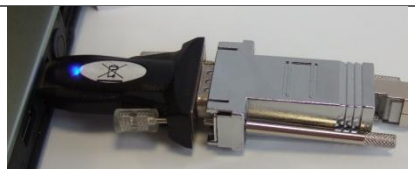
2 Serial communication and ethernet configuration

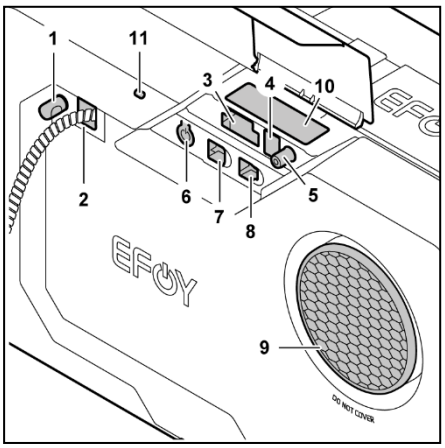
2.1 Serial communication with EFOY fuel cells

The SIO-commands can be used for serial communication with the EFOY fuel cell via a Terminal program.
For example: Terminal 2014, v.1.39b – provided by SFC
Required components:

Interface Adapter IA1	151 075 011
USB Adapter	151 906 018
Data Cable RJ-45 / RJ-12	158 906 008 (in urgent cases a cable RJ-12 / RJ-12 can also be used)
Windows PC	With installed terminal program, example: Terminal 2014

1. Connect the EFOY fuel cell to a windows PC by using the EFOY Interface Adapter IA1, USB Adapter and data cable
2. Connect the RJ-12 connector into the plug nr. 8 on the fuel cell.
3. Open the Terminal and follow the instructions in the PDF





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2.2 ETH command

SFC›ETH ‹ARGUMENT›

Displays or sets the Ethernet configuration.

Possible transmission parameters:

Argument	Description
	Display DHCP client state, IP, mask, gateway, hardware address, device name
DHCP [ON|OFF]	Turn DHCP client on or off. Renew DHCP with ON command.
SET ‹IP› ‹Mask› ‹Gateway›	Set the current IP configuration, DHCP must turned off before.
CLAIMING	Get claiming key if one is set and not expired.
MODBUS [ON [‹Port›]|OFF]	**Caution: The mode opens an unsecure port into the network and thus requires a secure local network with firewall, otherwise there are great risks for attacks on the EFOY.** Enables the unsecure Modbus mode at user defined port. (Default port is 502). EFOY must reset after turn off command to disable the Modbus mode or after changing the port.
CN	Common name (Device name)
RXER	Error counter, irrelevant to end user
LINK	Physical link and DCHP client state

Example 1

SFC›ETH

Ethernet cable connected
Connected to IoT Hub
DHCP client: On
IP: 10.1.6.56
Mask: 255.255.0.0
Gateway: 10.1.255.1
Hardware Address: E4:1E:0A:6F:AC:B1

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