

FACTORY AUTOMATION

AS-INTERFACE

# MAINTENANCE AND TROUBLESHOOTING GUIDE



**PEPPERL+FUCHS**  
*SENSING YOUR NEEDS*



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## AS-INTERFACE BASICS

- Use only certified modules, gateways/scanners, and power supplies.
- Total segment cable length is 100 m. (See page 12.) This includes the total of all trunk and drop lines.
- One AS-Interface power supply is required per segment. For example, a network with 2 repeaters requires 3 power supplies.
- Exactly one gateway/scanner is required per network.
- 31 addresses maximum; extended addressing, 1-31a and 1-31b, is permitted on 2.1 and 3.0 spec. networks for a total of 62 nodes.
- Address 0 (the factory default address) is used for automatic addressing and is not permitted on a running system.
- Modules with extended addressing and 4-in/4-out are permitted only on networks where an M4 (3.0) master is used.
- Update time per module is 150  $\mu$ s. The formula for scan time is  $150 \mu\text{s} \times (\text{number of addresses} + 2)$ 
  - Single addresses require 1 scan
  - Dual addresses (a and b) require 2 scans
  - Dual addresses (a and b) 3.0 4-in/4-out require 2 scans for inputs and 4 scans for outputs
  - Analog modules (2.1) require 7 scans per point
  - Analog modules (3.0) require 3 or 4 scans per point
- Network cable can be run in any topology.
- No shield or termination is required.
- Specification-compliant flat or round cable must be used.
- Do not ground either AS-i + or – under any circumstances anywhere on the network (ground fault). The network has a differential communication signal.

# ADDRESSING MODULES

- If only one module has failed:
  - remove failed module
  - connect new module

As long as the new module is identical (i.e., has the same I/O and ID codes and has address 0 before connection), no additional steps are necessary.

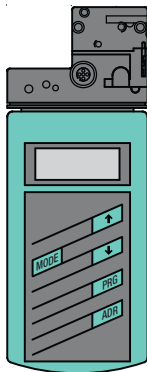
- If more than one module has failed:
  - remove all failed modules
  - use handheld programmer VBP-HH1 to manually assign addresses to all but one replacement module
  - the last replacement module will receive its address automatically

**Note:** The VAZ-PK-1.5M-V1-G addressing cable is required to work with any module using an addressing jack.

## Setting an Address Using Handheld Programmer

1. Connect the module to the handheld using either the addressing cable, M12 receptacle, or direct connection.
2. Press the “ADR” button to display the current address of the module
3. Use arrow “↑ ↓” buttons to choose new address
4. Press “PRG” button to set selected address
5. Press “ADR” button to confirm address

The diagnostic LEDs on the gateway/scanner indicate a fault when one or more modules are missing or are not properly connected to network.

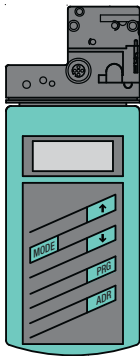


# HANDHELD PROGRAMMER

The handheld programmer is a diagnostic tool that is used to read the inputs or set the outputs on a module. This is often done to isolate and troubleshoot a specific I/O point.

## Procedure to Read Inputs and Set Outputs

- Make sure the handheld is in ADDR mode. This allows the address to be read. Press the “MODE” button until the ADDR mode is selected.
- Press “ADR” button and verify address is not zero. (If zero, see previous page to set valid address.)
- Change mode to DATA by pressing the “MODE” button 4x or 7x depending on module type. (Menu will repeat if you go too far.)
- Use arrow “↑ ↓” buttons to select output value
- Press and hold “PRG” button to turn outputs on
- Press and hold “ADR” button to read inputs



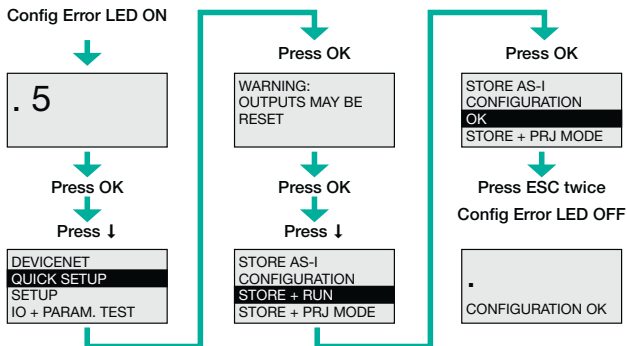
Note: The chart below shows which inputs or outputs are activated when the hexadecimal digit is displayed.

Display	0	1	2	3	4	5	6	7
Inputs	none	I1	I2	I1, I2	I3	I1, I3	I2, I3	I1, I2, I3
Outputs	none	O1	O2	O1, O2	O3	O1, O3	O2, O3	O1, O2, O3

Display	8	9	A	b	c	d	E	F
Inputs	I4	I4, I1	I4, I2	I4, I2, I1	I4, I3	I4, I3, I1	I4, I3, I2	I4, I3, I2, I1
Outputs	O4	O4, O1	O4, O2	O4, O2, O1	O4, O3	O4, O3, O1	O4, O3, O2	O4, O3, O2, O1

# GATEWAY QUICK START

When modules are added or removed from the network, the gateway detects this and indicates a “Config Error.” For gateways with a graphical display, use the following procedure to make the detected configuration (i.e., all modules found on the network) the active configuration.



## Gateway LED Functionality

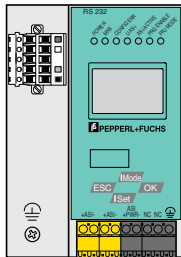
LED	Indication	Meaning
Power	● On (Green)	Power on
Config Error	● On (Red)	One slave missing or extra slave on the network
	⚠ Flashing (Red)	Peripheral fault on network
U AS-i	● On (Green)	AS-i network is sufficiently powered
AS-i Active	● On (Green)	AS-i network operating normally in either configuration or protected mode
PRG Enable	● On (Green)	Exactly one slave is missing in protected operating mode and automatic addressing is allowed
PRJ Mode	● On (Yellow)	AS-i master is in configuration mode

# GATEWAY ADVANCED FEATURES

Some gateways have advanced diagnostic features that can assist in finding network problems. The built-in fault detector will display new and old network errors. All advanced diagnostics are found on the display by going to ADV. DIAGNOSIS > AS-I CIRCUIT *x* > ...

## Error Counters

- If a node requires at least 2 consecutive retries, counts will appear on the display next to that node address. A clean network will have few or no retries. Single retries are automatically handled at the AS-Interface chip level and cannot be detected using the gateway. (Counts always go up by 2.)
- If any node has 6 consecutive retries, it appears in the LCS with an X by the node address. (This node caused a configuration error.)



ERROR COUNTERS	
RESET	
1A - 0	
2A - 0	

RESET	
APF -	1A - x
2A -	3A -
4A - x	5A -

## Fault Detector

The following errors occurred in the past (HISTORIC) or are currently happening (ACTUAL). Duplicate addresses are also displayed on this screen.

- EFLT:** An earth or ground fault has occurred. Check to make sure that AS-i + or - is not touching machine ground anywhere.
- OVRV:** A power spike occurred on AS-i such that the AS-i voltage was too high.
- NOIS:** Noise was detected. Route AS-i cable away from potential noise sources.

FAULT DETECTOR	
RESET	
HISTORIC:	
EFLT OVRV NOIS	
ACTUAL:	
EFLT OVRV NOIS	
DUP ASI ADR:	
0	31B
HELP:	
EFLT EARTH FAULT	
NOIS NOISE	
DUP ASI ADR	
DUPLICATE ASI	
SLAVE ADDRESS	

Compared to standard modules, exchanging a SafetyNode requires a few additional steps. See procedure for single and multiple node replacement.

## Exchanging a Single Failed SafetyNode

1. Remove SafetyNode.
2. Lightly press the “Service” button on all affected SafetyMonitors. LEDs 1, 2, and 3 will cycle slowly on the SafetyMonitor.
3. Connect replacement SafetyNode, make sure it receives an AS-i address and its inputs are closed so that full safety-code sequences are received by the SafetyMonitor.
4. Press the “Service” button on all affected SafetyMonitors. If successful, LEDs 1, 2, 3 will turn off and the SafetyMonitor will start normally.

## Exchanging Multiple Failed SafetyNodes

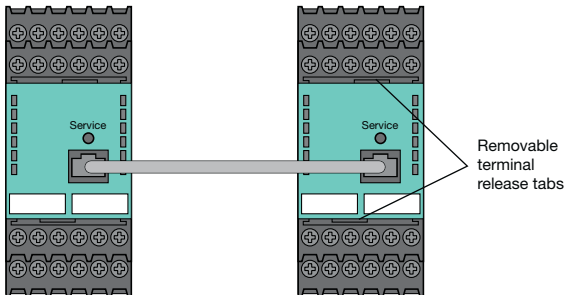
1. Remove all defective SafetyNodes.
2. Use handheld programmer VPB-HH1 to manually assign all addresses. (See page 4.) Confirm there is no configuration error on gateway/scanner. (Make sure all e-stops are pressed, all gates are open, and all light curtains are broken such that S1 and S2 safety input LEDs are off on all recently replaced SafetyNodes.)
3. The safety sequence must now be taught by following the procedure in “Exchanging a Single Failed SafetyNode.” Repeat this procedure for every recently replaced SafetyNode on the network.



**ATTENTION!** After replacing the defective SafetyNodes, make certain to check the new modules for correct functionality.

## EXCHANGING SAFETYMONITORS

1. Disconnect the failed SafetyMonitor from the 24 VDC power supply. Both L+ and M must be removed!
2. Use the special download cable, VAZ-SIMON-RJ45. Connect the new and old SafetyMonitors together.



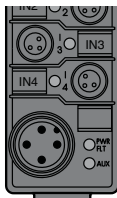
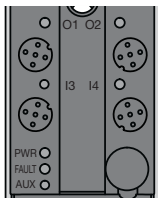
The replacement SafetyMonitor must be new with no configuration or have a configuration that is not validated.

3. Power up replacement SafetyMonitor by connecting both L+ and M.
4. Press the “Service” button on replacement SafetyMonitor.

On the replacement SafetyMonitor, active transmission is indicated when the yellow READY LED is illuminated. Transfer is complete when the GREEN and YELLOW LEDs are both lit.

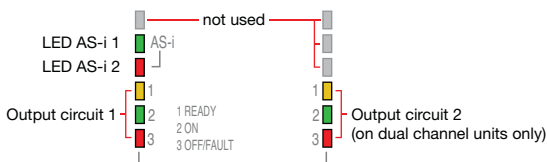
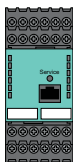
5. Disconnect defective SafetyMonitor and move all cables to replacement SafetyMonitor. (Version 2.14 has keyed removable terminals. Press the release tab in at the top of the monitor and pull terminals straight up to remove.)

# LED FUNCTIONALITY (MODULES)



LED	Indication	Meaning
PWR AS-i	<input type="radio"/> Off	No power
	<input checked="" type="radio"/> On (Green)	Normal
	<input type="radio"/> Flashing (Green)	Address 0 (FAULT LED on) or peripheral fault (FAULT LED flashing)
FAULT	<input type="radio"/> Off	Normal
	<input checked="" type="radio"/> On (Red)	No AS-i communication; check address
	<input type="radio"/> Flashing (Red)	Peripheral fault; check I/O
PWR/FLT	<input type="radio"/> Off	No power
	<input checked="" type="radio"/> On (Green)	Normal
	<input checked="" type="radio"/> On (Red)	No AS-i communication; check address
	<input type="radio"/> Alternating (Red/Yellow)	Address 0
	<input type="radio"/> Alternating (Red/Green)	Peripheral fault; check I/O
AUX	<input type="radio"/> OFF	No AUX power; check black AS-Interface cable
	<input checked="" type="radio"/> ON	Normal
I In	<input type="radio"/> OFF	Input OFF; no AUX power or wire broken
	<input checked="" type="radio"/> ON	Input ON
O Out	<input type="radio"/> OFF	Output OFF; no AUX power or output not set by PLC
	<input checked="" type="radio"/> ON	Output ON
	<input checked="" type="radio"/> ON	Output shorted/overloaded (if supported by module)

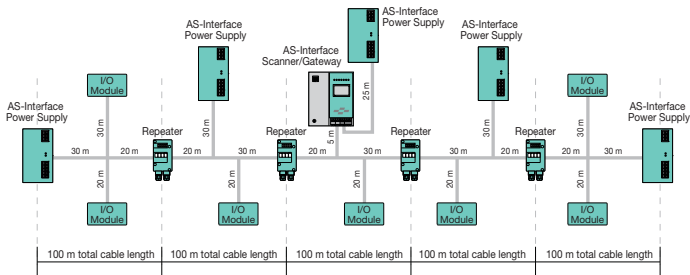
# LED FUNCTIONALITY (SAFETY MONITORS)



LED	Indication	Meaning
AS-i 1	<input type="checkbox"/> Off	No 30 V AS-i connection to AS-i+ and AS-i- terminals
	<span style="color: green;">■</span> On (Green)	Normal
AS-i 2	<input type="checkbox"/> Off	Normal operation
	<span style="color: red;">■</span> On (Red)	No AS-i communication or monitor address not stored in gateway/scanner
1 READY	<span style="color: yellow;">■</span> On (Yellow)	Waiting for start condition or door unlock condition
	<span style="color: yellow;">⚡</span> Flashing (Yellow)	Safety module test, local acknowledge required, or diagnostic stop enabled
2 ON	<span style="color: green;">■</span> On (Green)	Contacts of the output switching elements closed
	<span style="color: green;">⚡</span> Flashing (Green)	Delay time runs in event of Stop Category 1
3 OFF/FAULT	<span style="color: red;">■</span> On (Red)	Contacts of the output switching elements open
	<span style="color: red;">⚡</span> Flashing (Red)	Error on level of the monitored AS-i components
1 READY 2 ON 3 OFF/FAULT	<span style="color: yellow;">⚡</span> Simultaneously flashing rapidly <span style="color: green;">⚡</span> <span style="color: red;">⚡</span>	Internal device error; power cycle is required
1 READY 2 ON 3 OFF/FAULT	<span style="color: yellow;">⚡</span> Cycling slowly <span style="color: green;">⚡</span> <span style="color: red;">⚡</span>	Learning safety code sequences
1 READY 2 ON 3 OFF/FAULT	<input type="checkbox"/> <input type="checkbox"/> Off <input type="checkbox"/>	No 24 V supply connected to L+ and M terminals

# REPEATERS

The communication path between an AS-i module and gateway/scanner must not go through more than 2 repeaters. This example shows a network with 5 segments, 4 repeaters, and a total length of 500 m. Note the position of the gateway in the *middle* segment.

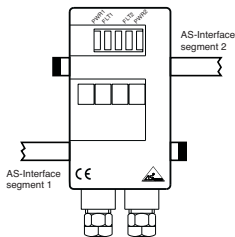


A repeater adds a second galvanically isolated segment to the AS-i network. Because only communication passes through the repeater a second power supply is required. Never put more than one power supply on a segment!

LED	Indication	Meaning
PWR	○ Off	No power supply connected
	● On (Green)	Normal
FAULT	○ Off	Normal
	● On (Red)	No communication

A network that is properly setup will have:

- One gateway/scanner
- One power supply per segment
- No segment with more than 100 m total cable length
- No module separated from the gateway/scanner by more than 2 repeaters



# TERMINATOR AND TUNER

The fixed terminator, VAZ-TERM, extends the network to 200 m, and the tuner, VAZ-TUNER, extends the AS-i network to 300 m. These devices, however, will not correct problems caused by noise or bad AS-i cable.

## Requirements for installation

- The best network to extend is linear. A network that has many drops/branches may not be extendable.
- The power supply must be located at one end of the network segment and the terminator/tuner at the other end.
- If a repeater is to be used an “Advanced” repeater is required. The advanced repeaters VAR-G4F or VAR-KE3-TERM (with termination switch built in) have a faster response time, which is required to couple long segments together.
- Always use analyzer VAZ-ANALYZER to verify network integrity.

## Tuning procedure

Gateway/scanner:

1. Put in configuration mode by holding “mode” button for 5 seconds.

Tuner:

1. Rotate “mode” switch to 2 (tuning)
2. Press “set” button until LEDs strobe red, yellow, green, red...
4. When strobing stops (this may take several minutes), rotate “mode” switch to 3 (run)

### Tuner LED Indication

LED	Indication	Meaning
Error	● On (Red)	Greater than 5% retries
Warning	● On (Yellow)	1% to 5% retries
Green	● On (Green)	Less than 1% retries

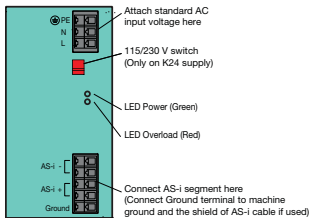
### Terminator LED Indication

Indication	Meaning
○ Off	No power or voltage below 18.5 V
● On (Yellow)	Voltage above 18.5 V
● On (Green)	Voltage above 26 V

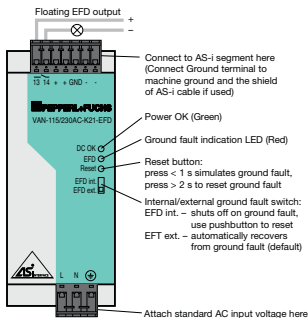
# POWER SUPPLIES

- Exactly one AS-Interface power supply is required for each segment.
- Only one ground/earth fault detection circuit should be used in each segment. This circuit could be on the power supply, gateway, or SafetyMonitor.
- Some gateways have duplicate address detection. To operate, the power supply must be connected directly to the dedicated terminal (labeled +PWR-) on the gateway.

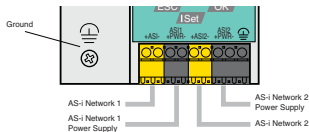
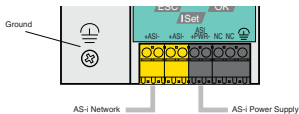
## Standard power supply wiring



## Power supplies with ground fault detection



## Power supply connection for gateways



The network analyzer, VAZ-ANALYSER, provides information about network stability and allows detailed analysis of protocol-specific communication detail.

There are two modes of operation. The first is *online statistics* where the overall health of the network is read. The second is *trace mode* where individual AS-i telegrams are recorded, filtered, and viewed for later analysis. This mode is often used to track down specific input, output or timing problems.

## Online Statistics

### Advance statistics (check for)

- Little or no missing telegrams
- No slave telegrams without master call

### Consecutive errors

- Make sure consecutive errors are kept to a minimum. (6x = configuration error)

### Network overview

- Check to make sure all connected nodes are green

Single Slave/Slave Status					0 Slaves			
Slave ID	Master Tel	Missing	Master Tel	Missing	Master Tel	Missing	Master Tel	Missing
0		16	10000	0		16		
1		17	10000	0		17		
2		18	10000	0		18		
3		19	10000	0		19		
4		20	10000	0		20		
5		21		0		21		
6		22		0		22		
7		23		0		23		
8		24		0		24		
9	10000	0	25	0		25		
10	10000	0	26	0		26		
11	10000	0	27	0		27		
12	10000	0	28	10000	0		28	
13	10000	0	29		0		29	
14	10000	0	30		14		30	
15	10000	0	31		15		31	

### I/O data

- Verify that the input and output data is correct
- Find out if a certain input is flickering or turning on for a short time by running a trace on that input

