

FBT-6

Fieldbus diagnostic monitor



- ◆ **fieldbus powered**
- ◆ **device add & drop indication**
- ◆ **shield short indication**
- ◆ **measures low, fieldbus and high frequency average and peak noise**
- ◆ **measures signal level for all segment devices**
- ◆ **assesses network health**
- ◆ **connects to intrinsically safe fieldbus in Zone 1 and Division 1 hazardous areas**
- ◆ **connects to non-incendive fieldbus in Zone 2 and Division 2 hazardous areas**
- ◆ **uploads measurement data to a PC via USB port**

The Fieldbus diagnostic monitor, FBT-6, is used to examine the operation of a live FOUNDATION fieldbus™ H1 network without interfering with its operation. The Monitor is intended for maintenance personnel to verify network operation or to troubleshoot an errant network.

The FBT-6 diagnostic monitor checks for retransmissions from each device on the segment, providing a key performance indicator of the networks health. Measurements of bus voltage level, device signal level, and peak and average noise level. It displays the number of devices present on the segment and indicates when devices are added or removed from the network. It also detects the presence of a short between either of the signal wires and the cable shield.

Modern fieldbus commissioning procedures require various bus parameters to be measured and recorded. Key parameters include bus voltage, signal level for each device and noise level on each

segment or at every device on each segment and recording the results allows a baseline of the fieldbus physical layer to be established. The FBT-6 collects this data, and allows up to eight file sets of data to be saved for uploading to a PC via a USB port. The data is uploaded as a tab-delimited text file and may then be used to create comprehensive commissioning and operations reports. Considerable savings can be achieved by reducing commissioning time and verifying the accuracy of the data on the segment.

Data collected from periodic network verification testing or during troubleshooting can be simply transferred to a file for easy comparison to the segment baseline/history measurements. Data can be displayed as tables and graphs using commonly available software such as Microsoft® Excel.

Hand-held for portability, the FBT-6 is powered by the fieldbus so that no batteries or external power source is required. It includes colour-coded test leads and an LCD display.

Operation

The FBT-6 is connected to the network using the clip-on probes at the end of the cable. The red probe is connected to the fieldbus + wire, the black probe to the - wire and the green probe to the shield wire. The + and - test leads are polarity sensitive and the Monitor will not operate if they are reversed.

When first connected to a fieldbus, a version number is displayed for several seconds. The Monitor then performs an Overall Network Check to give the user a quick indication of network health.

The "FUNCTION" and "SELECT" buttons are used to select from network parameters that can be examined with the Monitor. When a function is selected, the data portion of the LCD display is blank until the Monitor has collected and processed the data. After that, the measured value is shown. The indication "OK" is shown if the measured value is within the acceptable range. The indication "BAD" is shown if the measured value is outside of the acceptable range. The rotating symbol in the lower right corner of the display indicates that there is network activity. A horizontal bar (underscore) under the rotating symbol indicates that a frame was detected, but could not be decoded. This is not a maintained function, so if a single "bad" frame is detected, the underscore will only display for a short time. Periodic "bad" frames will cause the underscore to blink.

Here follows a more detailed explanation of each of the Monitor's functions.

Segment Check

When first connected, the FBT-6 gathers data for all of its monitoring functions. If all the measured data is within an acceptable range, the Monitor displays "ALL MEASUREMENTS OK".

Voltage

The DC voltage on the network is shown. Measurements over 9 volts are OK. The maximum input voltage is 32.0 volts.

Device Count

If there are fieldbus devices active on the network, the Monitor counts them. If the count has remained the same since the initial network check was performed, the display shows "OK".

Note, on FOUNDATION fieldbus™ networks, the Link Active Scheduler (LAS) is considered a device and, as such, is included in the count.

The FBT-6 is more sensitive to missed communications than most PC monitoring software. As a result, a device may still show up on PC monitoring software, even though the FBT-6 has removed the device from its internal list of active devices. Devices having communication difficulties may show up on the FBT-6 as repeatedly being added or dropped. If a device leaves the network, the display shows "-"; if a new device is added it shows "+".

Low

The signal level of the device with the weakest signal is shown. The device's address (in decimal and hexadecimal) is also displayed. This will be the lowest signal level reading from a device since the Monitor was connected to the fieldbus. Measurements greater than 150mV are OK.

Device

The address (in decimal and hexadecimal) and signal level of each device on the network is displayed in turn by pushing the "SELECT" button. On FOUNDATION fieldbus™ networks, the first device shown will be the LAS. Measurements greater than 150mV are OK.

Average Noise

Displays the average noise based on the average of the last 100 noise measurements. Noise levels are measured and displayed in 3 frequency bands: frequencies in the fieldbus signalling band (Fieldbus Frequency, FF), frequencies below the fieldbus signalling band (Low Frequency, LF) and frequencies above the fieldbus signalling band (High Frequency, HF). The particular frequency band displayed is selected by pushing the "SELECT" button. Measurements of less than 75mV are OK.

Peak Noise

Displays the peak noise recorded since the Monitor was connected. The value displayed is the highest noise level measured since the last reset. Peak noise levels are measured and displayed in the same three frequency bands as average noise. Measurements of less than 75mV are OK.

Retransmit

The FBT-6 checks for any device not responding to a LAS pass token and indicates the address (decimal and hexadecimal) of the last device that failed to respond to the LAS pass token, together with the number of missed pass tokens since the function was reset. If more than 250 re-transmissions are detected, the display will read "250+". Pressing and holding the "SELECT" key for 2 seconds will reset the re-transmit count for all devices to zero. Pressing the "SELECT" button for less than 2 seconds displays the number of detected, missed pass tokens for each device.

Add-Drop

If a new device is added to the network, the Monitor will display its address and signal level. If a device does not respond to a Pass Token frame, the device is considered "dropped" by the FBT-6 and the Monitor will display the address and last known signal level of the dropped device.

Shield Short

If a short circuit between the + fieldbus wire and the cable shield is detected, "(+) TO SHIELD SHORT" is displayed. If the short is between the - wire and the shield, "(-) TO SHIELD SHORT" is displayed. If a detected shield short goes away the Monitor indicates an INTERMITTENT SHIELD SHORT to (+) or (-).

Save Report

Saves the data collected by the Monitor as a report. Up to 8 reports may be saved from multiple segments and/or multiple locations on one segment.

Transfer Report

Connect the Monitor to a PC USB port and transfer the saved reports to Excel files on the PC.

Set Report Names

Customize the names of the reports saved in the Monitor to easily identify the report source

Set OK/BAD Limits

Change the limits at which Monitor measurements transition from OK to BAD to establish customized plant standards.



SPECIFICATIONS

Input voltage

8 to 32V DC

Input current

Fieldbus mode: 10mA max. ‡

USB mode: 30mA max.

Power dissipation

Fieldbus mode: 320mW max. (@ 32V DC)

USB mode: 165mW max. (@ 5.5V DC)

Operating Temperature

-20 to +50°C *

Dimensions

146 x 88 x 28 mm (5.7 x 3.5 x 1.1 inches)

Weight

378g (0.83lb)

Case Material

ABS

Case Specifications

Provides IP54 protection

DC Voltage measurement range

8 to 32 ± 0.5 V DC

Noise measurement ranges

LF (50Hz to 4kHz): 0 to 1000 mVpp ±15% ± 25mVpp

FF (9kHz to 40kHz): 0 to 1000 mVpp ±10% ± 25mVpp †

HF (90kHz to 350kHz): 0 to 250 mVpp ±20% ± 25mVpp

Signal level measurement range

0.12 to 2Vpp ± 25mVpp

Software utility and drivers

Operating system: Windows® XP, Windows® 2000

USB version: 1.1, 2.0

(Note: Vpp = Volts peak-to-peak)

- * Display update speed is impaired below -10°C
- † Excessive noise adjacent to the fieldbus frequency (FF) will prevent the FBT-6 from reading the fieldbus data and thus reduce functionality.
- ‡ In fieldbus mode the FBT-6 is powered by the fieldbus and draws approximately 9.4mA of current from the network (depending on bus voltage and ambient temperature).

Specifications subject to change without notice.



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APPROVALS

Region (Authority)	Standard	Certificate	Approved For	Ratings		
US (FM)	3600, 3610, 3611, 3810	3023564	Class I, Div 2, ABCD, T4 Class I, Zone 2, IIC T4	V _{max} (V) I _{max} Gps A, B/IIC (mA) I _{max} Gps C, D/IIC,IIA (mA)	NIFW 32 1500 1500	FNICO 17.5 183 380
US (FM)	3600, 3610, 3611, 3810	3023564	Class I, Div 1, ABCD, T4 Class I, Zone 0 and 1, AEx/Ex ia IIC T4	U _i (V) I _{max} Gps A, B/IIC (mA) I _{max} Gps C, D/IIC,IIA (mA) P _i (W)	Entity IS 24 250 250 1.2	FISCO 17.5 183 380 5.32
Canada (FM)	C22.2 No. 213, C22.2 No. 157 CAN/CSA-E79-0-95, CAN/CSA-E79-11-95	3028840	Class I, Div 2, ABCD, T4 Class I, Zone 2, IIC T4	U _i (V) I _{max} Gps A, B/IIC (mA) I _{max} Gps C, D/IIC,IIA (mA)	NIFW 32 1500 1500	FNICO 17.5 274 570
Canada (FM)	C22.2 No. 213, C22.2 No. 157 CAN/CSA-E79-0-95, CAN/CSA-E79-11-95	3028840	Class I, Div 1, ABCD, T4 Class I, Zone 0 and 1, AEx/Ex ia IIC T4	U _i (V) I _{max} Gps A, B/IIC (mA) I _{max} Gps C, D/IIC,IIA (mA) P _i (W)	Entity IS 24 250 250 1.2	FISCO 17.5 183 380 5.32
EU (LCIE)	EN60079-0 (2004). Pr EN60079-11 (2005). EN60079-27 (2004)	LCIE 06 ATEX 6111 X	Ex ia IIC T4	U _i (V) I _i (mA) P _i (W)	Entity IS 24 250 1.2	FISCO 17.5 380 5.32
EU (Relcom)	IEC 60079-0 (2004) IEC 60079-15 (2006) IEC 60079-11 (2005)	501-316	Ex nL IIC T4 Ex ic IIC T4	V _{max} = 32V, I _{max} = 1.5A		

ORDERING INFORMATION

Part Number	Description	Picture
FBT-6	FOUNDATION fieldbus™ H1 Diagnostic Monitor supplied in carrying case with FBT-A61, -A62, and -A63 cables, software and instruction manual.	
FBT-A61	FBT-6 Fieldbus Cable with Mini-Hook Probes	
FBT-A62	FBT-6 USB Cable	
FBT-A63	FBT-6 Fieldbus Cable with Clip-on Probe	
FBT-A64	Clip-on Probe	
501-338	FBT-6 User Manual	

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FBT-6-PA



- ◆ fieldbus powered
- ◆ device add & drop indication
- ◆ shield short indication
- ◆ measures low, fieldbus and high frequency average and peak noise
- ◆ measures signal level for all segment devices
- ◆ assesses network health
- ◆ upload measurement data to a PC via USB port

The Profibus PA Diagnostic Monitor, FBT-6-PA, is used to examine the operation of a live Profibus-PA segment without interfering with its operation. The Monitor is intended for maintenance personnel to verify segment operation or to troubleshoot an errant segment.

The FBT-6-PA Diagnostic Monitor checks for retransmissions from each device on the segment, providing a key performance indicator of segment health. The Monitor also provides measurements of bus voltage level, device signal level, and peak and average noise level. It displays the number of devices present on the segment and indicates when devices are added or removed from the segment. It also detects the presence of a short between either of the signal wires and the cable shield.

Modern fieldbus commissioning procedures require various bus parameters to be measured and recorded. Key parameters include bus voltage, signal level for each device and noise level on each segment or at every device on each segment.

Recording the results allows a baseline of the fieldbus physical layer to be established. The Monitor collects this data, and saves up to eight segment reports to be saved for transfer to a PC via a USB port. The reports are saved as Microsoft® Excel files as a comprehensive commissioning and operations report. Considerable savings can be achieved by reducing commissioning time and verifying the correct operation of the segment.

Data collected from periodic segment verification testing or during troubleshooting can be simply transferred to a file for easy comparison to the segment baseline/history measurements. Data can be displayed as tables and graphs using Microsoft® Excel.

Hand-held for portability, the Monitor is powered by the fieldbus so that no battery or external power source is required. It includes colour-coded test leads and an LCD display.

OPERATION

The FBT-6-PA is connected to the segment using the clip-on probes at the end of the cable. The red probe is connected to the fieldbus + wire, the black probe to the - wire and the green probe to the shield wire. The + and - test leads are polarity sensitive and the Monitor will not operate if they are reversed.

When first connected to a fieldbus, a version number is displayed for several seconds. The Monitor then performs a Segment Check providing a quick indication of segment health.

The "FUNCTION" and "SELECT" buttons are used to choose from segment parameters that can be examined with the Monitor. When a function is selected, the data portion of the LCD display is blank until the Monitor has collected and processed the data. After that, the measured value is shown. The indication "OK" is shown if the measured value is within the acceptable range. The indication "BAD" is shown if the measured value is outside of the acceptable range.

The rotating symbol in the lower right corner of the display indicates that there is segment activity. A horizontal bar (underscore) under the rotating symbol indicates that a frame was detected, but could not be decoded. This is not a maintained function, so if a single "bad" frame is detected, the underscore will only display for a short time. Periodic "bad" frames will cause the underscore to blink. The following are more detailed explanations of each of the Monitor's functions.



Segment Check

When first connected, the FBT-6-PA gathers data for all of its monitoring functions. If all measured data is within acceptable range, the Monitor displays "ALL MEASUREMENTS OK".

Voltage

The DC voltage on the segment is shown. By default, measurements over 9 volts are OK. The maximum input voltage is 32.0 volts.

Device Count

If Profibus PA devices are active on the segment, the Monitor counts them. If the count has remained the same since the initial segment check was performed, the display shows "OK". Note, on Profibus PA segments, the Master is considered a device and, as such, is included in the count.

The FBT-6-PA is more sensitive to missed communications than most PC monitoring software. As a result, a device may still show up on PC monitoring software, even though the FBT-6-PA has removed the device from its internal list of active devices. Devices having communication difficulties may show up on the FBT-6-PA as repeatedly being added or dropped.

If a device leaves the segment, the display shows "-"; if a new device is added it shows "+".



Device

The address (in decimal and hexadecimal) and signal level of each device on the segment is displayed in turn by pushing the "SELECT" button. The first device shown will be the Master. By default, measurements greater than 150mV are OK. If a device leaves the segment, a "-" is displayed; if a device is added it shows "+".

Average Noise

Displays the average of the most recent 100 noise measurements. Noise levels are measured and displayed in 3 frequency bands: frequencies in the fieldbus signalling band (Fieldbus Frequency, FF), frequencies below the fieldbus signalling band (Low Frequency, LF) and frequencies above the fieldbus signalling band (High Frequency, HF). The particular frequency band displayed is selected by pushing the "SELECT" button.

Peak Noise

Displays the peak noise recorded since the Monitor was connected. The value displayed is the highest noise level measured since the last reset. Peak noise levels are measured and displayed in the same three frequency bands as average noise.

Retransmit

If a device does not respond to a request frame or a token frame, the frame is retransmitted. The FBT-6-PA indicates the address (decimal and hexadecimal) of the last device that failed to respond, together with the number of retransmits since the function was reset. If more than 250 retransmits are detected, the display will read "250+". Pressing the "SELECT" button cycles through screens indicating the number of detected retransmits for each device.

Shield Short

If a short circuit between the + fieldbus wire and the cable shield is detected, "(+) TO SHIELD SHORT" is displayed. If the short is between the - wire and the shield, "(-) TO SHIELD SHORT" is displayed. If a detected shield short goes away the Monitor indicates an INTERMITTENT SHIELD SHORT to (+) or (-).

Add-Drop

If a new device is added to the segment, the Monitor will display its address and signal level. If a frame is retransmitted to a device, the device is considered "dropped" by the FBT-6-PA and the Monitor will display the address and last known signal level of the dropped device. A Master device that is sent an FDL Status Request frame is also considered dropped.

Low

The signal level of the device with the weakest signal is shown. The device's address (in decimal and hexadecimal) is also displayed. This will be the lowest signal level reading from a device since the Monitor was connected to the fieldbus. By default, measurements greater than 150mV are OK.



Save Report

Saves the data collected by the Monitor as a report. Up to 8 reports may be saved from multiple segments and/or multiple locations on one segment.

Transfer Report

Connect the Monitor to a PC USB port and transfer the saved reports to Excel files on the PC.

Set Report Names

Customize the names of the reports saved in the Monitor to easily identify the report source.

Set OK/BAD Limits

Change the limits at which Monitor measurements transition from OK to BAD to establish customized plant standards.

SPECIFICATIONS

Input voltage

Fieldbus Mode: 8 to 32 VDC
USB Mode: 4.1 to 5.5 VDC

Input current

Fieldbus mode: 10mA max.‡
USB mode: 30mA max.

Power dissipation

Fieldbus mode: 320mW max. (@ 32 VDC)
USB mode: 165mW max. (@ 5.5 VDC)

Operating Temperature

-20 to +50°C *

Dimensions

146 x 88 x 28 mm (5.7 x 3.5 x 1.1 inches)

Weight

378g (0.83lb)

Case Material

ABS

DC Voltage measurement range

8 to 32 ± 0.5 VDC

Signal level measurement range

0.12 to 2 Vpp ±10% ± 25mVpp

Noise measurement ranges

LF (50Hz to 4kHz): 0 to 1000 mVpp ±15% ± 25 mVpp
FF (9kHz to 40kHz): 0 to 1000 mVpp ±10% ± 25 mVpp †
HF (90kHz to 350kHz): 0 to 250 mVpp ±20% ± 25mVpp

Software utility and drivers

Operating system: Windows® XP, Windows® 2000

USB version:

1.1, 2.0

(Note: Vpp = Volts peak-to-peak)

‡ In fieldbus mode the FBT-6-PA is powered by the fieldbus and draws approximately 9.4mA of current from the segment (depending on bus voltage and ambient temperature).

* Display update speed is impaired below -10°C

† Excessive noise adjacent to the fieldbus frequency (FF) band will prevent the FBT-6-PA from reading the fieldbus data and thus reduce functionality.

Specifications subject to change without notice.

Profibus PA Segment Diagnostic Report			
Report 7 Segment Report			
Segment Measurements	Data	Acceptable Values	OK/BAD
Voltage	12.5V	12.0V Minimum	OK
Lowest Device Signal	161mV	150mV Minimum	OK
Lowest Device Signal Address	85 (55H)		
Avg Fieldbus Frequency Noise	0mV	75mV Maximum	OK
Peak Fieldbus Frequency Noise	0mV	75mV Maximum	OK
Avg Low Frequency Noise	3mV	150mV Maximum	OK
Peak Low Frequency Noise	4mV	150mV Maximum	OK
Avg High Frequency Noise	0mV	150mV Maximum	OK
Peak High Frequency Noise	0mV	150mV Maximum	OK
Shield Short	No Shorts	No Shorts	OK
Most Recent Add/Drop Address	No Devices Added/Dropped		
Device Add or Drop	None Added/Dropped	None Added/Dropped	OK
Number of Active Devices	1		
Device Measurements	Data	Acceptable Values	OK/BAD
Device Address	85 (55H)		
Signal Level	163mV	150mV Minimum	OK
Added/Dropped	Not Added/Dropped	Not Added/Dropped	OK
Master or Slave	Master		
Retransmits	0	2	OK

Measurement Summary: All Measurements are OK

Data collected by _____

Report approved by _____



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APPROVALS

Region (Authority)	Standard	Certificate	Approved For	Ratings		
US (FM)	3600, 3610, 3611, 3810	3023564	Class I, Div 2, ABCD, T4 Class I, Zone 2, IIC T4	V _{max} (V) I _{max} Gps A, B/IIC (mA) I _{max} Gps C, D/IIC,IIA (mA)	NIFW 32 1500 1500	FNICO 17.5 183 380
US (FM)	3600, 3610, 3611, 3810	3023564	Class I, Div 1, ABCD, T4 Class I, Zone 0 and 1, AEx/Ex ia IIC T4	U _i (V) I _{max} Gps A, B/IIC (mA) I _{max} Gps C, D/IIC,IIA (mA) P _i (W)	Entity IS 24 250 250 1.2	FISCO 17.5 183 380 5.32
Canada (FM)	C22.2 No. 213, C22.2 No. 157 CAN/CSA-E79-0-95, CAN/CSA-E79-11-95	3028840	Class I, Div 2, ABCD, T4 Class I, Zone 2, IIC T4	U _i (V) I _{max} Gps A, B/IIC (mA) I _{max} Gps C, D/IIC,IIA (mA)	NIFW 32 1500 1500	FNICO 17.5 274 570
Canada (FM)	C22.2 No. 213, C22.2 No. 157 CAN/CSA-E79-0-95, CAN/CSA-E79-11-95	3028840	Class I, Div 1, ABCD, T4 Class I, Zone 0 and 1, AEx/Ex ia IIC T4	U _i (V) I _{max} Gps A, B/IIC (mA) I _{max} Gps C, D/IIC,IIA (mA) P _i (W)	Entity IS 24 250 250 1.2	FISCO 17.5 183 380 5.32
EU (LCIE)	EN60079-0 (2004). Pr EN60079-11 (2005). EN60079-27 (2004)	LCIE 06 ATEX 6111 X	Ex ia IIC T4	U _i (V) I _i (mA) P _i (W)	Entity IS 24 250 1.2	FISCO 17.5 380 5.32
EU (Relcom)	IEC 60079-0 (2004) IEC 60079-15 (2006) IEC 60079-11 (2005)	501-316	Ex nL IIC T4 Ex ic IIC T4	V _{max} = 32V, I _{max} = 1.5A		

ORDERING INFORMATION

Part Number	Description	Picture
FBT-6-PA	Profibus PA Diagnostic Monitor supplied in carrying case with FBT-A61, -A62, and -A63 cables, software and instruction manual.	
FBT-A61	FBT-6-PA Fieldbus Cable with Mini-Hook Probes	
FBT-A62	FBT-6-PA USB Cable	
FBT-A63	FBT-6-PA Fieldbus Cable with Clip-on Probe	
FBT-A64	Clip-on Probe	
501-366	FBT-6-PA User Manual	

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