



# **Instruction manual Foundation™ Fieldbus Interface**



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# ***Instruction manual*** ***FOUNDATION™ Fieldbus Interface***

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## Preface

This manual is intended for technicians involved with the commissioning and service of the Enraf Series 854 Servo ATG, 970 SmartRadar ATi, 971 SmartRadar LTi and 973 SmartRadar LT with optional FOUNDATION™ Fieldbus Interface.

A description preceding the technical procedures gives the technical information necessary to understand its functioning. It is recommended to read this description prior to performing any of the procedures.

### Safety and prevention of damage

Refer to the chapter Safety in the instruction manual of the 854 Servo ATG, 970 SmartRadar ATi, 971 SmartRadar LTi and 973 SmartRadar LT for detailed safety instructions.

"**Warnings**", "**Cautions**", and "**Notes**" have been used throughout this manual to bring special matters to the immediate attention of the reader.

- A **Warning** concerns danger to the safety of the technician or user;
- A **Caution** draws attention to an action which may damage the equipment;
- A **Note** points out a statement deserving more emphasis than the general text, but does not deserve a "Warning" or a "Caution".

The sequence of steps in a procedure may also be important from the point of view of personal safety and prevention of damage; it is therefore advised not to change the sequence of procedure steps or modify any procedure in any other way.

### Legal aspects

The commissioning and troubleshooting to the instrument may only be conducted by qualified engineers, trained by Enraf and with knowledge of safety regulations for working in hazardous areas.

The information in this manual is the copyright property of Enraf B.V., Netherlands. Enraf B.V. disclaims any responsibility for personal injury or damage to equipment caused by:

- Deviation from any of the prescribed procedures;
- Execution of activities that are not prescribed;
- Neglect of the general safety precautions for handling tools and use of electricity.

### EC declaration of conformity

This instrument is in conformity with the protection requirements of EC Council Directive 93/68/EEC. The CE conformity marking fulfills the provisions of:

- 89/336/EEC regarding EMC:
  - EN 50081-2 Generic Emission Standard
  - EN 50082-2 Generic Immunity Standard
- 73/23/EEC regarding Low Voltage Directive
- 94/09/EEC regarding ATEX
- 97/23/EEC regarding PED Directive

### Additional information

Please do not hesitate to contact Enraf or its representative if you require any additional information.

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# 1 Introduction

By means of the FOUNDATION™ Fieldbus Interface (FFI) Enraf offers the option to integrate the SmartRadar and servo level gauge series directly into FOUNDATION™ Fieldbus H1 network topologies. The basis function of the FFI is to convert all gauging data of Enraf's level gauge products into FOUNDATION™ Fieldbus.

The FF H1 interface is an intrinsically safe interface and can therefore be used in hazardous as well as in non-hazardous environments.

The FFI offers by means of five Analog Input (AI) function blocks and one Discrete Output (DO) function block a wide variety of functionality and process variables on the FF network. These function blocks can be freely used to present six different measured values and to control an internal contact switch.

The process parameters that can be used as an input for the AI blocks are:

- Product level
- Radar sensor temperature (not available for the servo gauge)
- Product Temperature
- Vapour Temperature
- Vapour Pressure
- Observed Density
- Water Level

For reading this manual basic FOUNDATION™ Fieldbus knowledge is expected.

## 2 Abbreviation list

<b>AI</b>	: Analog Input
<b>ATEX</b>	: ATmosphères EXplosives
<b>AWG</b>	: American Wire Gauge
<b>dB/m</b>	: Decibel per meter
<b>DO</b>	: Digital Output
<b>FFI</b>	: Foundation™ Fieldbus Interface
<b>FISCO</b>	: Fieldbus Intrinsically Safe Concept
<b>HART</b>	: Highway Addressable Remote Transmitter
<b>HIMS</b>	: Hybrid Inventory Measurement System
<b>HTG</b>	: Hydrostatic Tank Gauging
<b>IEC</b>	: International Electrotechnical Commission
<b>IS</b>	: Intrinsically Safe
<b>ITK</b>	: Interoperability Test Kit
<b>Kbit/sec</b>	: Kilobits per second
<b>RB</b>	: Resource Block
<b>TB</b>	: Transducer Block



## 3 FOUNDATION™ Fieldbus Technical Data

### 3.1 Registration

<b>Manufacturer ID</b>	: 'N' 'R' 'F' (0x4E5246).
<b>Device ID:</b>	
854 Servo ATG	: 800 (0x320)
970 SmartRadar ATi	: 900 (0x384)
971 SmartRadar LTi	: 900 (0x384)
973 SmartRadar LT	: 900 (0x384)

### 3.2 Transmission

<b>Type</b>	: International open fieldbus physical layer standard IEC 1158-2
<b>Physical layer type</b>	: 112 standard power signaling, separately powered I.S.
<b>Protocol</b>	: FOUNDATION™ Fieldbus H1
<b>Data rate</b>	: 31.25 kbit/sec

### 3.3 Features

<b>H1 device class</b>	: Basic device
<b>Number of VCR's</b>	: 24
<b>Jumpers</b>	: write lock and simulation (see Appendix A for the location of the jumpers).
<b>Polarity insensitive</b>	: Yes
<b>Stack manufacturer</b>	: Softing AG, revision 2.11
<b>Interoperability Test Kit version</b>	: ITK 4.6
<b>FF blocks:</b>	
1 x Resource Block (RB)	
5 x Transducer Block (TB)	: Product Level Water Level Temperature (Vapour and Product) Pressure (Vapour Pressure and Observed Density) Contact Switch
6 x Analog Input (AI)	
1 x Discrete Output (DO)	

### 3.4 Data files

<b>Servo</b>	: Device Description file: 4E5246\0320\0101.ffo Capability file: 4E5246\0320\010101.cff Symbol file 4E5246\0320\0101.sym
<b>SmartRadar</b>	: Device Description file: 4E5246\0384\0101.ffo Capability file: 4E5246\0384\010101.cff Symbol file 4E5246\0384\0101.sym

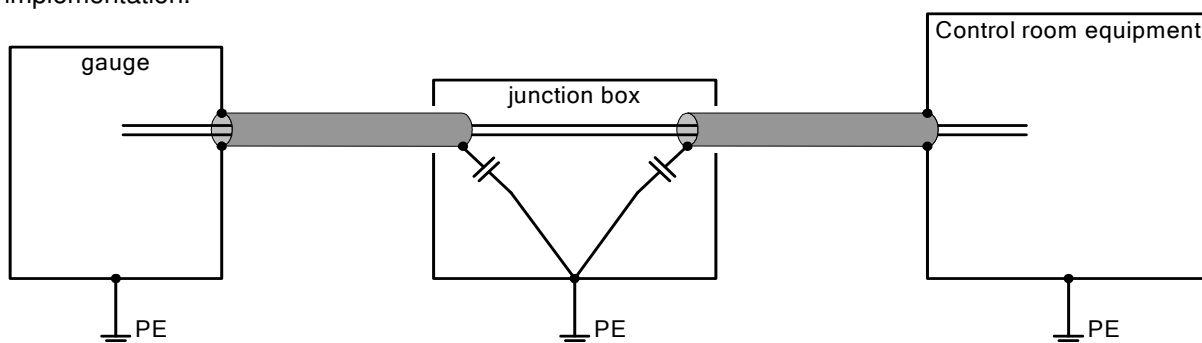
## 4 Wiring and electrical characteristics

### Cabling (recommended)

Fieldbus Type A (Shielded twisted pair plus overall screen)	
Wire size	: 18 AWG (0.8 mm)
Attenuation	: 3 dB/km at 39 kHz
Characteristic Impedance	: 100 Ohms
Shield	: 90% coverage

### Grounding

To suppress low-frequency equalizing in systems without equipotential bonding, we recommend connecting only one side of the cable shield directly with local ground (normally connected through the cable gland to the external housing) and capacitive connection to all other grounding points. The next figure shows a possible implementation.



### Connection

Please refer to the Instrument Installation guide for the connection instructions.

### Maximum distance (without repeaters)

1900 meter (6270 feet)

### Power supply

The fieldbus interface is bus powered and is galvanic isolated from the other parts of the gauge. The FFI has the following characteristics:

Voltage	: 9 V – 24 V
Operating current	: 11 mA
Maximum current (startup)	: 16,70 mA

### Polarity

The FFI is polarity insensitive.

### I.S. parameters

The Fielbus Interface is conform to the FISCO model of EN-IEC 60079-27:2003 with following parameters

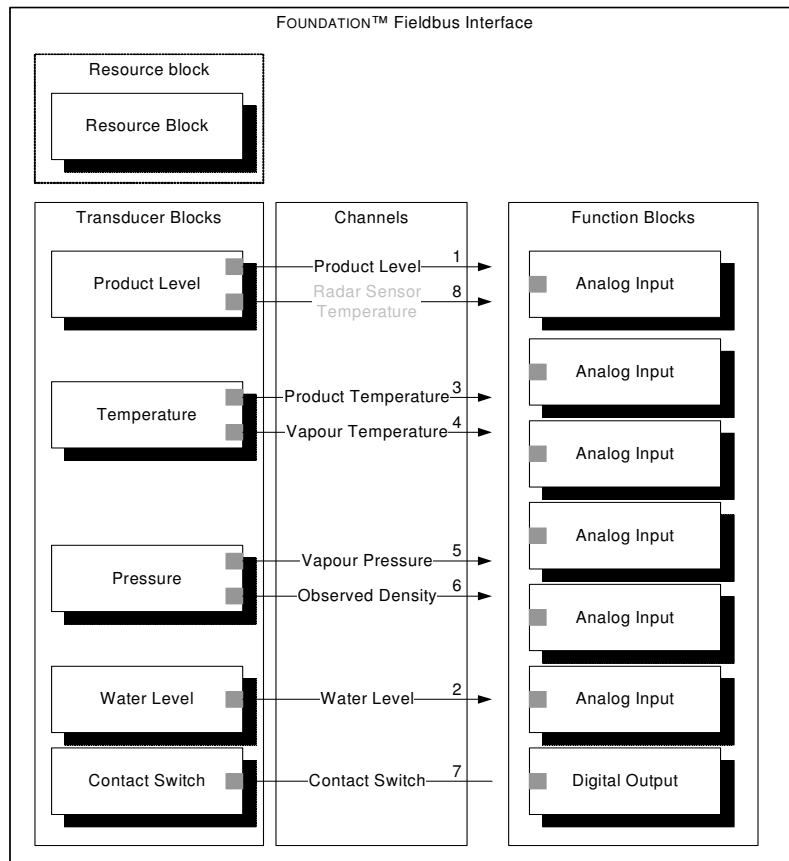
U <sub>i</sub>	: • 24 V
I <sub>i</sub>	: • 380 mA
P <sub>i</sub>	: • 5,32 W
L <sub>i</sub>	: < 6,5 μH
C <sub>i</sub>	: < 1,8 nF

### Approvals

IEC Ex	: Ex ia IIC
ATEX	: II(2) G [EEx ia] II C
	Ta = -40°C ... + 85°C

## 5 FOUNDATION™ Fieldbus blocks

The FOUNDATION™ Fieldbus Interface has a total of five Transducer Blocks, six Function Blocks and one Resource block.



## 5.1 Resource Block

The Resource Block (RB) contains diagnostic, hardware and electronics information. It shows the details and of the gauge and the FFI. Some of the attributes are listed below. The names between brackets are the names used in the device descriptor.

### Manufacturer ID (*MANUFAC\_ID*)

Holds the Enraf B.V. manufacturer ID : 'N' 'R' 'F' (0x4E5246).

### Device Type (*DEV\_TYPE*)

Holds the device type:

854 Servo ATG	800
970 SmartRadar ATi	900
971 SmartRadar LTi	900
973 SmartRadar LT	900

### FFI Software Revision (*FFI\_SW\_REVISION*)

The Enraf FOUNDATION™ Fieldbus Interface software revision.

### FFI Hardware Revision (*FFI\_HW\_REVISION*)

The Enraf FOUNDATION™ Fieldbus Interface hardware revision.

### Available Gauge options (*AVAILABLE\_GAUGE\_OPTIONS*)

The options available in this gauge and are supported by the FOUNDATION™ Fieldbus interface. This could be as much as six options:

- Product level
- Product Temperature
- Vapour Temperature
- Vapour Pressure
- Observed Density
- Water Level
- Contact Switch

### Disable / Enable Alarms and Events (*ALM\_EVT\_OPTION*)

With these attributes it is possible to turn off an alarm or event, in such a way that an alarm or event is not triggered even if the conditions are met. The table below shows the coding of this attribute.

The attribute is bit enumerated. When the bit corresponding with the alarm or event is set the alarm or event is suppressed.

Attribute code (hex)	Attribite code (binary)	Alarm / Event
0x0001	---- ---- ---- 0001	Radar measurement malfunction
0x0002	---- ---- ---- 0010	General radar signal processing warning
0x0004	---- ---- ---- 0100	Reduced accuracy detected by level gauge
0x0008	---- ---- ---- 1000	Water level measurement malfunction
0x0010	---- ---- 0001 ----	Gas temperature measurement malfunction
0x0020	---- ---- 0010 ----	Vapour temperature measurement malfunction
0x0040	---- ---- 0100 ----	Temperature element fail
0x0080	---- ---- 1000 ----	Transmitter or interface fail
0x0100	---- 0001 ---- ----	Transmitter exceeding range
0x0200	---- 0010 ---- ----	Relais failed
0x0400	---- 0100 ---- ----	Relais not mounted
0x0800	---- 1000 ---- ----	General fatal error

Each alarm or event has this option individually. It is not recommended to use this option.

**Device Software Version** (*DEVICE\_SOFTWARE\_VERSION*)

Identification string containing the software version of the main and sensor boards.

**Radar Sensor Board Software Version** (*DAB\_VERSION*)

Radar sensor board software version.

**Operating Hours** (*OPERATING\_HOURS*)

Hours running since the instrument is turned on for the first time.

**ALARM: General fatal error**

If this alarm is set a serious error is encountered. This could be for example a serious hardware error. Please contact Enraf B.V. for support.

**FFI Status** (*FFI\_STATUS*)

The Foundation™ Fieldbus Interface status. This attribute is bit enumerated (see table below).

Status code	Description	
0x01	FFI operates without failure	Device works normal. No action required.
0x02	EEPROM failure	Memory error. Please contact Enraf B.V. for support.
0x04	RAM failure	
0x08	CRC failure	
0x10	Sensor board not available	Internal hardware error. Please contact Enraf B.V. for support.
0x20	Fatal serial com. error	
0x40	Serial communication lost	

## 5.2 Channels

The FFI has eight channels that can be used to connect the resource blocks to the function blocks.

channel	Description
1	Product Level
2	Water Level
3	Product Temperature
4	Vapour Temperature
5	Vapour Pressure
6	Observed Density
7	Contact Switch
8	Radar Sensor Temperature

Channel 8 (Radar Sensor Temperature) is for diagnostic purposes only.

## 5.3 Function Blocks

The FFI has six Analog Input blocks and one Discrete Output block that can be used to connect the resource blocks

### 5.3.1 Simulate Jumper

The simulate jumper is used in conjunction with the Analog Input (AI) function block. This switch is used to simulate the measurement and as a lock-out feature for the AI function block. To enable the simulate feature, switch into position “ENABLE” while the transmitter is powered.

**Note:** When power is cycled to the transmitter, simulation is automatically disabled regardless of the position of the jumper. This prevents the transmitter from being accidentally left in simulation mode. Therefore, to enable the simulate feature, the jumper must be inserted after power is applied to the transmitter.

### 5.3.2 Write Protection Jumper

With the write protection jumper the FFI can be set to read only or to read and write access.

### 5.3.3 Engineering Units

The Analog Input blocks support different engineering units.

Symbol	Unit name
m	Meter
ft	Feet
in	Inch
°C	Celsius
°F	Fahrenheit
Pa	Pascal
kPa	Kilopascal
psi	Pounds per square inch
kg/m <sup>3</sup>	kilogram per cubic meter
lbm/ft <sup>3</sup>	pounds per cubic foot
degAPI	degrees API
%	Percent

## 5.4 Transducer Block: Product Level

The Product Level Transducer Block connects an AI block with the level sensor board. Due to the difference in measuring principle the transducer differs for the SmartRadar series and the servo gauge.

For proper operation some items in the gauge need to be set to the right value.

Item	Value	Description
GT	'B'	The gauge communication protocol must be set to GPU protocol.
DE	'I'	The level type must be set to innage.

If one of these items is not set correct a block error is set.

### Primary Value (channel: Product Level)

The primary value of this transducer block is the Product Level. This value can be directed to an Analog Input block via the channel 'Product Level'.

### Secondary Value (channel: Radar Sensor Temperature) *(Not applicable for 854 Servo ATG)*

This value is the measured temperature inside the Radar Sensor. This value can be directed to an AI block via the channel 'Radar Sensor Temperature'.

### Engineering units

Following level units are supported by this block for the primary value:

Symbol	Unit name
m	Meter
ft	Feet
in	Inch

These engineering units can (also) be set via the AI block.

### Alarms and Events

The supported alarms and events supported are:

Alarm / Event	Description
Alarm	Radar measurement malfunction
Event	General radar signal processing warning
Event	Reduced accuracy detected by level gauge

### Servo Commands (only applicable for Servo)

This block supports Servo Commands. The supported commands are:

Command	Equivalent Item
Servo command unlock	UN
Servo command lock test	LT
Servo command block	BL
Servo command test gauge	TG
Servo command verify calib	CA

## 5.5 Transducer Block: Water Level

The Water Level Transducer Block connects an AI block with the water sensor. For proper operation some items in the gauge need to be set to the right value.

Item	Value	Description
GT	'B'	The gauge communication protocol must be set to GPU protocol.
DE	'I'	The level type must be set to innage.

If one of these items is not set correct a block error is set.

### Primary Value (channel: Product Level)

The primary value of this transducer block is the Water Level. This value can be directed to an Analog Input block via the channel 'Water Level'.

### Secondary Value

This block has no Secondary Value.

### Engineering units

Following level units are supported by this block for the primary value:

Symbol	Unit name
m	Meter
ft	Feet
in	Inch

These engineering units can (also) be set via the AI block.

### Alarms and Events

The alarms and events supported are:

Alarm / Event	Description
Alarm	Water level measurement malfunction



## 5.6 Transducer Block: Temperature

The Temperature Transducer Block connects the AI blocks with the product temperature sensor(s) and vapor temperature sensor(s).

**Note:** If a temperature option is not available this block will never leave 'Out of Service'.

For proper operation some items in the gauge need to be set to the right value.

Item	Value	Description
GT	'B'	The gauge communication protocol must be set to GPU protocol.

If this item is not set correct a block error is set.

### Primary Value (channel: Product Temperature)

The primary value of this transducer block is the Product Temperature. This value can be directed to an AI block via the channel 'Product Temperature'.

### Secondary Value (channel: Vapor Temperature)

The secondary value of this transducer block is the Vapor Temperature. This value can be directed to an AI block via the channel 'Vapor Temperature'.

### Engineering units

Following temperature units are supported by this block for the primary and secondary value:

Symbol	Unit name
°C	Celsius
°F	Fahrenheit

### Alarms and Events

Alarm / Event	Description
Alarm	Gas temperature measurement malfunction
Alarm	Vapor temperature measurement malfunction
Event	Temperature element fail

## 5.7 Transducer Block: Pressure

The Pressure Transducer Block connects the AI blocks with the Vapour pressure sensor(s) and observed density sensor(s).

**Note:** If a pressure (Hart® input) option is not available this block will never leave 'Out of Service'.

For proper operation some items in the gauge need to be set to the right value.

Item	Value	Description
GT	'B'	The gauge communication protocol must be set to GPU protocol.

If this item is not set correct a block error is set.

### Primary Value (channel: Vapour Pressure)

The primary value of this transducer block is the Vapour Pressure. This value can be directed to an AI block via the channel 'Vapour pressure'.

### Secondary Value (channel: Observed Density)

The secondary value of this transducer block is the Observed Density. This value can be directed to an AI block via the channel 'Observed Density' (HIMS and HTG; obtained by Hart® transmitters).

### Engineering units

Following pressure units are supported by this block for the primary value:

Symbol	Unit name
Pa	Pascal
kPa	Kilopascal
psi	Pounds per square inch

Following density units are supported by this block for the secondary value:

Symbol	Unit name
kg/m <sup>3</sup>	kilogram per cubic meter
lbm/ft <sup>3</sup>	pounds per cubic foot
degAPI	degrees API

### Alarms and Events

Alarm / Event	Description
Alarm	Transmitter or interface fail
Event	Transmitter exceeding range

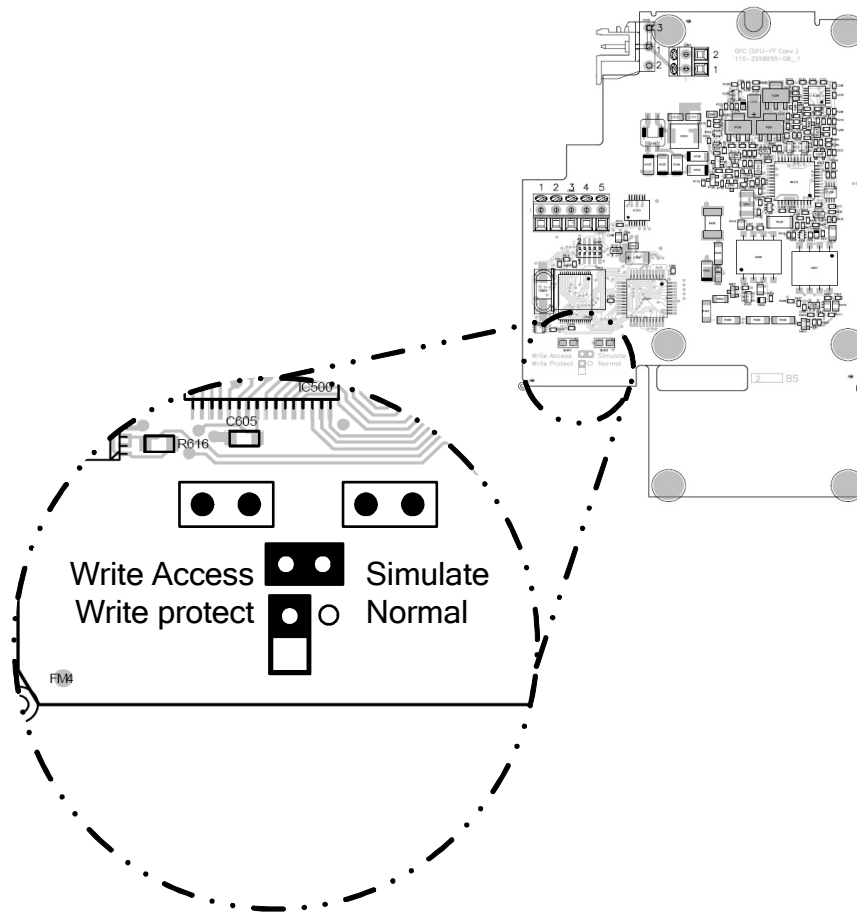
## 5.8 Transducer Block: Contact Switch

The Contact Switch Transducer Block connects the DO block with the internal Relay. The FOUNDATION™ Fieldbus system can use this Relay for control.

### Alarms and Events

Alarm / Event	Description
Alarm	Relays failed
Alarm	Relays not mounted

## Appendix A Position of Write Lock and Simulation jumper



## Appendix B FF parameters

### Resource Block

Parameter	Description
ACK_OPTION	Selection of whether alarms associated with the function block will be automatically acknowledged.
ALARM_SUM	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
ALM_EVT_OPTION	Option which the user may select to turn on/off an device specific alarm or event.
AVAILABLE_GAUGE_OPTIONS	Used to shows connected gauge options.
BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
CLR_FSTATE	Writing a Clear to this parameter will clear the device faultstate state if the field condition, if any, has cleared.
CONFIRM_TIME	The minimum time between retries of alert reports.
CYCLE_SEL	Used to select the block execution method for this resource.
CYCLE_TYPE	Identifies the block execution methods available for this resource.
DAB_VERSION	This item contains the software version of the DAB software.
DD_RESOURCE	String identifying the tag of the resource which contains the Device Description for this resource.
DD_REV	Revision of the DD associated with the resource - used by an interface device to locate the DD file for the resource.
DEV_REV	Manufacturer revision number associated with the resource - used by an interface device to locate the DD file for the resource.
DEV_TYPE	Manufacturer's model number associated with the resource - used by interface devices to locate the DD file for the resource.
DEVICE_SOFTWARE_VERSION	String representing the software versions of the main and option boards of the instrument.
FACTORY_DATA_B	Product information.
FACTORY_DATA_C	Product information.
FACTORY_DATA_D	Product information.
FATAL_TRANSMISSION_BOARD_ERRORS	The number of encountered fatal errors on the instrument communication board.
FAULT_STATE	Condition set by loss of communication to an output block, failure promoted to an output block or a physical contact. When faultstate condition is set, then output function blocks will perform their FSTATE actions.
FEATURE_SEL	Used to select resource block options.
FEATURES	Used to shows supported resource block options.
FFI_HW_REVISION	String representing the hardware version of the FFI board of the instrument.
FFI_STATUS	The current status of the FFI
FFI_SW_REVISION	String representing the software version of the FFI board of the instrument.
FREE_SPACE	Percent of memory available for further configuration. Zero in a preconfigured device.
FREE_TIME	Percent of the block processing time that is free to process additional blocks.
GPU_ANSWER	Enraf service answer channel.
GPU_POLL	Enraf service poll parameter.
GPU_REQUEST	Enraf service request channel.
GRANT_DENY	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.
HARD_TYPES	The types of hardware available as channel numbers.
ITK_VER	Major revision number of the interoperability test case used to register this device.
LAST_TRANSMISSION_BOARD_ERROR	Code representing the last encountered error on the instrument communication board.
LIM_NOTIFY	Maximum number of unconfirmed alert notify messages allowed.
MANUFAC_ID	Manufacturer identification number - used by an interface device to locate the DD file for the resource.
MAX_NOTIFY	Maximum number of unconfirmed alert notify messages possible.
MEMORY_SIZE	Available configuration memory in the empty resource. To be checked before attempting a download.

<b>MIN_CYCLE_T</b>	Time duration of the shortest cycle interval of which the resource is capable.
<b>MODE_BLK</b>	The actual, target, permitted, and normal modes of the block.
<b>NV_CYCLE_T</b>	Minimum time interval specified by the manufacturer for writing copies of NV parameters to non-volatile memory. NV memory is updated only if there has been a significant change in the dynamic value. The last value saved in NV memory will be available after restart. Zero means that NV data will only be copied to NV memory when an external write request is received.
<b>OPERATING_HOURS</b>	The number of operating hours of the instrument.
<b>PHYSICAL_JUMPER_POSITIONS</b>	Position of the 6 instrument communication board jumpers (0 = open; 1 = closed).
<b>PRODUCT_ID_CODE</b>	Product identification code.
<b>RB_ALARM</b>	The resource alarm is used for predefined device specific alarms.
<b>REASON_OF_LAST_INITIALISATION</b>	Code representing the reason why the instrument is restarted the last time.
<b>RESTART</b>	Allows a manual restart to be initiated. Several degrees of restart are possible. They are 1: Run, 2: Restart resource, 3: Restart with defaults, and 4: Restart processor.
<b>RS_STATE</b>	State of the function block application state machine.
<b>SET_FSTATE</b>	Allows the faultstate condition to be manually initiated by selecting Set.
<b>SHED_RCAS</b>	Time duration at which to give up on computer writes to function block RCas locations.
<b>SHED_ROUT</b>	Time duration at which to give up on computer writes to function block ROut locations.
<b>ST_REV</b>	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
<b>STRATEGY</b>	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
<b>TAG_DESC</b>	The user description of the intended application of the block.
<b>TEST_RW</b>	Read/write test parameter - used only for conformance testing.
<b>UPDATE_EVT</b>	This alert is generated by any change to the static data.
<b>WRITE_ALM</b>	This alert is generated if the write lock parameter is cleared.
<b>WRITE_LOCK</b>	Shows the state of the hardware switch. If set, no writes from anywhere are allowed. Block inputs will continue to be updated.
<b>WRITE_PRI</b>	Priority of the alarm generated by clearing the write lock.

## Transducer Block Level Common (SmartRadar and Servo)

Parameter	Description
ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
COLLECTION_DIRECTORY	A directory that specifies the number, starting indices, and DD Item IDs of the data collections in each transducer within a transducer block.
MODE_BLK	The actual, target, permitted, and normal modes of the block.
PRIMARY_VALUE	The measured value and status of available to the Function Block.
PRIMARY_VALUE_RANGE	The High and Low range limit values, the engineering units code and the number of digits to the right of the decimal point to be used to display the Primary Value.
PRIMARY_VALUE_TYPE	The type of measurement represented by the primary value. For Example: Mass Flow, Absolute Pressure, Differential Temperature.
REFERENCE_LEVEL	Reference level.
SECONDARY_VALUE	The secondary value related to the sensor.
SECONDARY_VALUE_UNIT	The engineering units to be used with SECONDARY_VALUE.
SENSOR_RANGE	The High and Low range limit values, the engineering units code and the number of digits to the right of the decimal point for the sensor.
SENSOR_TYPE	The type of sensor.
ST_REV	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
TAG_DESC	The user description of the intended application of the block.
TB_PRODUCT_LEVEL_ALARM	The product level alarm is used for predefined sensor specific alarms.
TB_PRODUCT_LEVEL_EVENT	The product level event is used for predefined sensor specific events.
TRANSDUCER_DIRECTORY	A directory that specifies the number and starting indices of the data collections in the transducer block.
TRANSDUCER_TYPE	Identifies the transducer that follows.
UPDATE_EVT	This alert is generated by any change to the static data.
UPPER_REFERENCE_LEVEL	Represents the distance from the 'innage' zero point (datum plate) to the upper reference point at a dip hatch (or other point at the tank top).
WM_PRODUCT_LEVEL	Weight and Measures product level.
XD_ERROR	One of the transducer error codes defined in the FF Transducer Specifications in section 4.7 Block Alarm Subcodes.

## Transducer Block Level SmartRadar

Parameter	Description
RADAR_MAX_SAFE_FILL	Value used to checks if the programmed upper measuring range is valid (only applicable for radar instrument).
RADAR_OFFSET_TO_ROOF	The distance from radar reference (mounting flange position) to the roof surface at the inner side of the tank (only applicable for radar instrument).
RADAR_OPERATIONAL_MODE	Mode in which the radar operates (F = free space; S = stilling well) (only applicable for radar instrument).
RADAR_SENSOR_TEMPERATURE	Temperature inside the instrument (only applicable for radar instrument).
RADAR_STILLING_WELL_DIAMETER	Diameter of the used stilling well (only applicable for radar instrument).
RADAR_TANK_HEIGHT	The vertical distance from the radar reference point to the tank zero (mostly the datum plate) (only applicable for radar instrument).
RADAR_TRUNK_LENGTH	Trunk height (only applicable for radar instrument).

## Transducer Block Level Servo

Parameter	Description
SERVO_AVERAGE_MEASURED_WEIGHT	The average force that was found during the balance test (only applicable for servo instrument).
SERVO_COMMAND_BLOCK	Servo block command (1 = on; 0 = off) (only applicable for servo instrument).
SERVO_COMMAND_LOCK_TEST	Servo lock command (1 = on; 0 = off) (only applicable for servo instrument).
SERVO_COMMAND_TEST_GAUGE	Servo test instrument command (1 = on; 0 = off) (only applicable for servo instrument).
SERVO_COMMAND_UNLOCK	Servo unlock command (1 = on; 0 = off) (only applicable for servo instrument).
SERVO_COMMAND_VERIFY_CALIB	Servo verify calibration command (1 = on; 0 = off) (only applicable for servo instrument).
SERVO_DISPLACER_AREA	Displacer area (only applicable for servo instrument).
SERVO_DISPLACER_VOLUME	Displacer volume (only applicable for servo instrument).
SERVO_DISPLACER_WEIGHT	Displacer weight (only applicable for servo instrument).
SERVO_LIMIT_SWITCH_HIGH_LEVEL	The highest allowed position for the displacer during normal operation (only applicable for servo instrument).
SERVO_LIMIT_SWITCH_LOW_LEVEL	The lowest allowed position for the displacer during normal operation (only applicable for servo instrument).
SERVO_MAX_UNBALANCED_WEIGHT	The maximum force that was found during the balance test (only applicable for servo instrument).
SERVO_MEASURED_DISPLACER_WEIGHT	Measured displacer weight (only applicable for servo instrument).
SERVO_MIN_UNBALANCED_WEIGHT	The minimum force that was found during the balance test (only applicable for servo instrument).
SERVO_STRESS_TRANSDUCER_FREQ	The measured frequency of the stress transducer (only applicable for servo instrument).
SERVO_TANK_TOP_LEVEL	Tank top level (only applicable for servo instrument).

## Transducer Block Water Level

Parameter	Description
ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
BOTTOM_POSITION_WATER_PROBE	Bottom position of the water probe.
COLLECTION_DIRECTORY	A directory that specifies the number, starting indices, and DD Item IDs of the data collections in each transducer within a transducer block.
MODE_BLK	The actual, target, permitted, and normal modes of the block.
PRIMARY_VALUE	The measured value and status of available to the Function Block.
PRIMARY_VALUE_RANGE	The High and Low range limit values, the engineering units code and the number of digits to the right of the decimal point to be used to display the Primary Value.
PRIMARY_VALUE_TYPE	The type of measurement represented by the primary value. For Example: Mass Flow, Absolute Pressure, Differential Temperature.
SECONDARY_VALUE	The secondary value related to the sensor.
SECONDARY_VALUE_UNIT	The engineering units to be used with SECONDARY_VALUE.
SENSOR_RANGE	The High and Low range limit values, the engineering units code and the number of digits to the right of the decimal point for the sensor.
SENSOR_TYPE	The type of sensor.
ST_REV	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
TAG_DESC	The user description of the intended application of the block.
TB_WATER_LEVEL_ALARM	The water level alarm is used for predefined sensor specific alarms.
TRANSDUCER_DIRECTORY	A directory that specifies the number and starting indices of the data collections in the transducer block.
TRANSDUCER_TYPE	Identifies the transducer that follows.
UPDATE_EVT	This alert is generated by any change to the static data.
XD_ERROR	One of the transducer error codes defined in the FF Transducer Specifications in section 4.7 Block Alarm Subcodes.



## Transducer Block Temperature

Parameter	Description
ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
COLLECTION_DIRECTORY	A directory that specifies the number, starting indices, and DD Item IDs of the data collections in each transducer within a transducer block.
MODE_BLK	The actual, target, permitted, and normal modes of the block.
MULTI_TEMP_ELEMENT_POSITION_0	Position of temperature element 0.
MULTI_TEMP_ELEMENT_POSITION_1	Position of temperature element 1.
MULTI_TEMP_ELEMENT_POSITION_2	Position of temperature element 2.
MULTI_TEMP_ELEMENT_POSITION_3	Position of temperature element 3.
MULTI_TEMP_ELEMENT_POSITION_4	Position of temperature element 4.
MULTI_TEMP_ELEMENT_POSITION_5	Position of temperature element 5.
MULTI_TEMP_ELEMENT_POSITION_6	Position of temperature element 6.
MULTI_TEMP_ELEMENT_POSITION_7	Position of temperature element 7.
MULTI_TEMP_ELEMENT_POSITION_8	Position of temperature element 8.
MULTI_TEMP_ELEMENT_POSITION_9	Position of temperature element 9.
MULTI_TEMP_ELEMENT_POSITION_10	Position of temperature element 10.
MULTI_TEMP_ELEMENT_POSITION_11	Position of temperature element 11.
MULTI_TEMP_ELEMENT_POSITION_12	Position of temperature element 12.
MULTI_TEMP_ELEMENT_POSITION_13	Position of temperature element 13.
MULTI_TEMP_ELEMENT_POSITION_14	Position of temperature element 14.
MULTI_TEMP_ELEMENT_POSITION_15	Position of temperature element 15.
MULTI_TEMP_PRODUCT_IMMERS_DEPTH	Part of the probe below product.
MULTI_TEMP_VAPOUR_IMMERS_DEPTH	Part of the probe above product.
MULTI_TEMPERATURE_LEVEL_OFFSET	The position of the anchoring-eye in respect with the zero-level of the tank.
MULTI_TEMPERATURE_SENSOR_LENGTH	Length of the used MTT probe.
NUMBER_OF_MULTI_TEMP_ELEMENTS	The number of multi temperature elements in the probe.
PRIMARY_VALUE	The measured value and status of available to the Function Block.
PRIMARY_VALUE_RANGE	The High and Low range limit values, the engineering units code and the number of digits to the right of the decimal point to be used to display the Primary Value.
PRIMARY_VALUE_TYPE	The type of measurement represented by the primary value. For Example: Mass Flow, Absolute Pressure, Differential Temperature.
RTD_OFFSET	Offset for the RTD measurement. This value is subtracted from the calculated spot-temperatures.
RTD_POSITION	The position of the RTD element.
SECONDARY_VALUE	The secondary value related to the sensor.
SECONDARY_VALUE_UNIT	The engineering units to be used with SECONDARY_VALUE.
SENSOR_RANGE	The High and Low range limit values, the engineering units code and the number of digits to the right of the decimal point for the sensor.
SENSOR_TYPE	The type of sensor.
ST_REV	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
TAG_DESC	The user description of the intended application of the block.
TB_TEMPERATURE_ALARM	The temperature alarm is used for predefined sensor specific alarms.
TB_TEMPERATURE_EVENT	The temperature event is used for predefined sensor specific events.
TEMPERATURE_SWITCH_HYSTERESIS	Hysteris value that is used to determine if an element is used for product temperature or vapour temperature calculation.
TRANSDUCER_DIRECTORY	A directory that specifies the number and starting indices of the data collections in the transducer block.
TRANSDUCER_TYPE	Identifies the transducer that follows.
UPDATE_EVT	This alert is generated by any change to the static data.
WM_PRODUCT_TEMPERATURE	Weight and Measures product temperature.
XD_ERROR	One of the transducer error codes defined in the FF Transducer Specifications in section 4.7 Block Alarm Subcodes.

## Transducer Block Pressure

Parameter	Description
ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
AVAILABLE_PRESSURE_TRANSMITTERS	Available pressure transmitters. (- = not available; 1/2/3 = available).
BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
COLLECTION_DIRECTORY	A directory that specifies the number, starting indices, and DD Item IDs of the data collections in each transducer within a transducer block.
MODE_BLK	The actual, target, permitted, and normal modes of the block.
PRIMARY_VALUE	The measured value and status of available to the Function Block.
PRIMARY_VALUE_RANGE	The High and Low range limit values, the engineering units code and the number of digits to the right of the decimal point to be used to display the Primary Value.
PRIMARY_VALUE_TYPE	The type of measurement represented by the primary value. For Example: Mass Flow, Absolute Pressure, Differential Temperature.
SECONDARY_VALUE	The secondary value related to the sensor.
SECONDARY_VALUE_UNIT	The engineering units to be used with SECONDARY_VALUE.
SENSOR_P1_MAXIMUM_TRIP_PRESSURE	Maximum trip pressure of P1.
SENSOR_P1_MINIMUM_TRIP_PRESSURE	Minimum trip pressure of P1.
SENSOR_P1_OFFSET	The pressure offset value with which the measured pressure in P1 is compensated before further calculations.
SENSOR_P1_TEMPERATURE	Value of the temperature sensor in P1.
SENSOR_P2_MAXIMUM_TRIP_PRESSURE	Maximum trip pressure of P2.
SENSOR_P2_MINIMUM_TRIP_PRESSURE	Minimum trip pressure of P2.
SENSOR_P2_OFFSET	The pressure offset value with which the measured pressure in P2 is compensated before further calculations.
SENSOR_P2_TEMPERATURE	Value of the temperature sensor in P2.
SENSOR_P3_MAXIMUM_TRIP_PRESSURE	Maximum trip pressure of P3.
SENSOR_P3_MINIMUM_TRIP_PRESSURE	Minimum trip pressure of P3.
SENSOR_P3_OFFSET	The pressure offset value with which the measured pressure in P3 is compensated before further calculations.
SENSOR_P3_TEMPERATURE	Value of the temperature sensor in P3.
SENSOR_RANGE	The High and Low range limit values, the engineering units code and the number of digits to the right of the decimal point for the sensor.
SENSOR_TYPE	The type of sensor.
ST_REV	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
TAG_DESC	The user description of the intended application of the block.
TB_PRESSURE_ALARM	The pressure alarm is used for predefined sensor specific alarms.
TB_PRESSURE_EVENT	The pressure event is used for predefined sensor specific events.
TRANSDUCER_DIRECTORY	A directory that specifies the number and starting indices of the data collections in the transducer block.
TRANSDUCER_TYPE	Identifies the transducer that follows.
UPDATE_EVT	This alert is generated by any change to the static data.
XD_ERROR	One of the transducer error codes defined in the FF Transducer Specifications in section 4.7 Block Alarm Subcodes.

## Transducer Block Contact Switch

Parameter	Description
ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
COLLECTION_DIRECTORY	A directory that specifies the number, starting indices, and DD Item IDs of the data collections in each transducer within a transducer block.
CONTACT_SWITCH_STATUS	Current status of the contact switch.
FINAL_VALUE_D	The requested valve position and status written by a discrete Function Block.
MODE_BLK	The actual, target, permitted, and normal modes of the block.
RADAR_CONTACT_SWITCH_MODE	Active mode of the contact switch.
SERVO_CONTACT_SWITCH_MODE	Active mode of the contact switch.
ST_REV	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
TAG_DESC	The user description of the intended application of the block.
TB_CONTACT_SWITCH_ALARM	The contact switch alarm is used for predefined sensor specific alarms.
TRANSDUCER_DIRECTORY	A directory that specifies the number and starting indices of the data collections in the transducer block.
TRANSDUCER_TYPE	Identifies the transducer that follows.
UPDATE_EVT	This alert is generated by any change to the static data.
XD_ERROR	One of the transducer error codes defined in the FF Transducer Specifications in section 4.7 Block Alarm Subcodes.

## Analog Input Block (all)

Parameter	Description
ACK_OPTION	Selection of whether alarms associated with the function block will be automatically acknowledged.
ALARM_HYS	Amount the PV must return within the alarm limits before the alarm condition clears. Alarm hysteresis expressed as a percent of the span of the PV.
ALARM_SUM	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
CHANNEL	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world.
FIELD_VAL	Raw value of the field device in % of PV range, with a status reflecting the Transducer condition, before signal characterization (L_TYPE) or filtering (PV_FTIME).
GRANT_DENY	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.
HI_ALM	The status for high alarm and its associated time stamp.
HI_HI_ALM	The status for high high alarm and its associated time stamp.
HI_HI_LIM	The setting for high high alarm in engineering units.
HI_HI_PRI	Priority of the high high alarm.
HI_LIM	The setting for high alarm in engineering units.
HI_PRI	Priority of the high alarm.
IO_OPTS	Option which the user may select to alter input and output block processing.
L_TYPE	Determines if the values passed by the transducer block to the AI block may be used directly (Direct) or if the value is in different units and must be converted linearly (Indirect), or with square root (Ind Sqr Root), using the input range defined for the transducer and the associated output range.
LO_ALM	The status of the low alarm and its associated time stamp.
LO_LIM	The setting for the low alarm in engineering units.
LO_LO_ALM	The status of the low low alarm and its associated time stamp.
LO_LO_LIM	The setting of the low low alarm in engineering units.
LO_LO_PRI	Priority of the low low alarm.
LO_PRI	Priority of the low alarm.
LOW_CUT	Limit used in square root processing. A value of zero percent of scale is used in block processing if the transducer value falls below this limit, in % of scale. This feature may be used to eliminate noise near zero from a flow sensor.
MODE_BLK	The actual, target, permitted, and normal modes of the block.
OUT	The primary analog value calculated as a result of executing the function block.
OUT_SCALE	The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the OUT parameter and parameters which have the same scaling as OUT.
PV	Either the primary analog value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK value of an AO block.
PV_FTIME	Time constant of a single exponential filter for the PV, in seconds.
SIMULATE	Allows the transducer analog input or output to the block to be manually supplied when simulate is enabled. When simulate is disabled, the simulate value and status track the actual value and status.
ST_REV	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
STATUS_OPTS	Options which the user may select in the block processing of status.
STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
TAG_DESC	The user description of the intended application of the block.
UPDATE_EVT	This alert is generated by any change to the static data.
XD_SCALE	The high and low scale values, engineering units code, and number of digits to the right of the decimal point used with the value obtained from the transducer for a specified channel.

## Digital Output Block

Parameter	Description
ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
BKCAL_OUT_D	The output value and status provided to an upstream block output tracking when the loop is broken, as determined by the status bits. This information is used to provide bumpless transfer to closed loop control.
BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
CAS_IN_D	This parameter is the remote setpoint value, which must come from another Fieldbus block, or a DCS block through a defined link.
CHANNEL	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world.
FSTATE_TIME	The time in seconds from detection of failure of the output block remote setpoint to the output action of the block output if the condition still exists.
FSTATE_VAL_D	The preset discrete SP_D value to use when failure occurs. This value will be used if the I/O option Faultstate to value is selected.
GRANT_DENY	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.
IO_OPTS	Option which the user may select to alter input and output block processing.
MODE_BLK	The actual, target, permitted, and normal modes of the block.
OUT_D	The primary discrete value calculated as a result of executing the function block.
PV_D	Either the primary discrete value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK value of an DO block.
PV_STATE	Index to the text describing the states of a discrete PV.
RCAS_IN_D	Target setpoint and status provided by a supervisory Host to a discrete control or output block.
RCAS_OUT_D	Block setpoint and status provided to a supervisory Host for back calculation and to allow action to be taken under limiting conditions or mode change.
READBACK_D	This indicates the readback of the actual discrete valve or other actuator position, in the transducer state.
SHED_OPT	Defines action to be taken on remote control device timeout.
SIMULATE_DISCRETE	Allows the transducer analog input or output to the block to be manually supplied when simulate is enabled. When simulate is disabled, the simulate value and status track the actual value and status.
SP_D	The discrete setpoint of this block.
ST_REV	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
STATUS_OPTS	Options which the user may select in the block processing of status.
STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
TAG_DESC	The user description of the intended application of the block.
UPDATE_EVT	This alert is generated by any change to the static data.
XD_STATE	Index to the text describing the states of a discrete for the value obtained from the transducer.

## Appendix C Related documents

Description	Part No.
Instruction manual 854 Servo Gauge	4416220
Instruction manual 970 SmartRadar ATI	4416718
Instruction manual 971 SmartRadar LTi	4416716
Instruction manual 973 SmartRadar LT	4416632
Installation guide 97x series SmartRadar	4416719
Instruction manual Temperature, Water bottom and Analog output options	4416644



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