KROHNE

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Supplementary Installation and Operating Instructions

IFC 090, IFC 090 i

With FOUNDATION FIELDBUS Communication

FOUNDATION™

KROHNE

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Contents:

1 Introduction

These instructions are supplementary to the “Installation and Operating Instructions IFC 090 K / F“. The details depicted therein, in particular the Safety Information are valid and should be adhered to. The present Supplementary Instructions provide additional information for the devices when being operated and connected to a Foundation Fieldbus.

Note: Please set the controller to manual mode before changing parameters of the IFC 090.

The present Supplementary Instruction for the IFC 090 with Foundation Fieldbus- interface, plus a diskette with the DD and CCF file are included in our scope of supply, in addition to those items delivered for the standard device.

2 Installation and Operation

2.1 Technical Data IFC090 FF

Hardware

Physical	to IEC 61158-2 and the FISCO model
Bus characteristics:	9... 30 V; 0.3 A max.; 4.2 W max.
Base current	10 mA
FDE	bus with separate fault detection electronics
Fault current	6 mA; (fault current = max. continuous current – base current)
Starting current	lower than the base current
“Ex“ approval	EEx ia IIC T6 or EEx ib IIC/IIB T6 in conformity with the FISCO model
Connection	independent of polarity

Software

DD, CFF File	supplied on diskette, available also in the KROHNE Downlaod Center
Functional blocks	flow [m3/s], integrator 1 [m3], integrator 2 [m3]; units are default units
Operator control	local display and operator interface at device

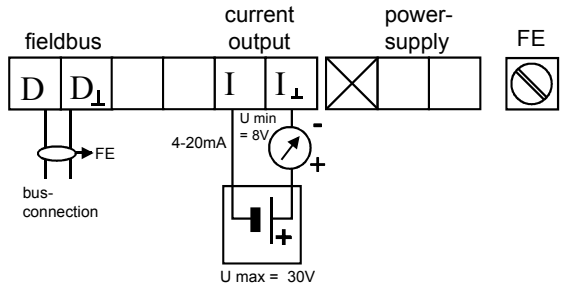
2.2 Electrical Connection of Foundation Fieldbus Devices

Connect the bus cable as shown in the figure.

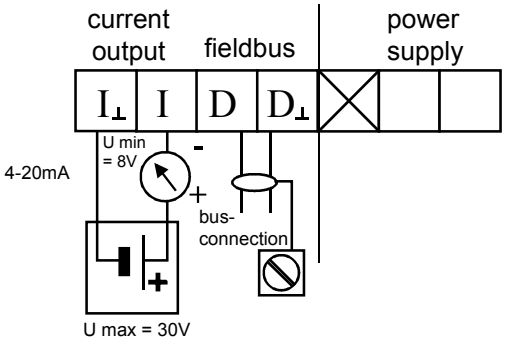
- Connect the cable cores to terminals D and D~~-~~. Polarity reversal will not have any effect.
- The cable shield should be connected with minimum length to the FE functional ground.
- The equipotential bonding conductor must be connected to the device by connecting it to FE functional ground.

Foundation Fieldbus with Current Output (passive)

Non Ex Version

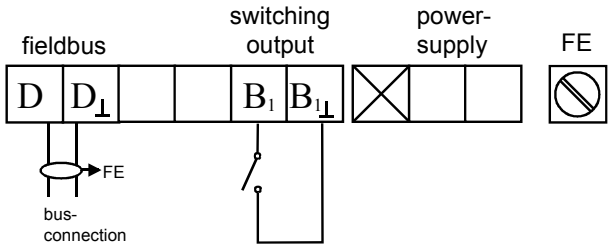


Outputs intrinsically safe

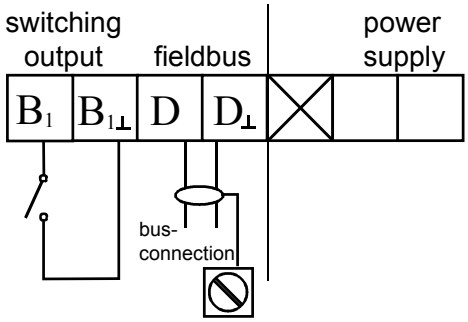


Foundation Fieldbus with Binary Output (passive)

Non Ex Version



Outputs intrinsically safe



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2.3 Installation in the Hazardous Area, Bus Cable

We recommend that a Foundation Fieldbus network in the hazardous area should be projected in accordance with PTB's FISCO model. The FISCO-Model is based on the following conditions:

- all electrical components which should be connected to the bus must be approved according to the FISCO model (even the termination)
- the maximum cable length should not exceed 1000 m,
- the values of the cable are within the following ranges: R´=15...150Ω/km; L´=0,4...1mH/km; C´=80...200nF/km, other limitations for the cable than the FISCO limitations are not existent. Nevertheless, a twisted pair and shielded cable is strongly recommended. Example: a good quality cable could have the following data: 44Ω/km, <90nF/km, <3dB attenuation at 39 kHz and 100 Ohm impedance at 31,25kHz.
- the approved input values of the field devices (Uo, Io, Po) comply to the output values of the power supply (e.g. segment coupler) according to UI ≤ Uo, II ≤ Io und PI ≤ Po.

2.4 Shielding and Grounding

For optimum electromagnetic compatibility of systems it is extremely important that the system components, and particularly the bus cables connecting the components, are shielded and that such shields - if possible - form an unbroken cover.

Hence, it follows that, for use in non-hazardous duty systems, the cable shield should be grounded as often as possible.

In “Ex“ systems an adequate equipotential bonding in the hazardous and non-hazardous location along the entire fieldbus installation is strongly recommended. Multiple grounding of the shield is of advantage.

Note: The use of twisted and shielded cables is strongly recommended, otherwise EMC protection of the IFC 090 cannot be assured.

2.5 IFC090 Menu Settings for Foundation Fieldbus

(see also Section 4 in the Installation and Operating Instructions for the IFC090)

The following settings need to be made for operation of the IFC 090 on a Foundation Fieldbus network. Note that the address can be set by the service “set slave address” as well.

Function (Fct.)	Description
3.9 COM	Select function for the communication port ♦ OFF ♦ HART ♦ PROFI PA *

- Note: * indicates Foundation Fieldbus Communication when selected

2.6 Foundation Fieldbus Functional Blocks

The IFC090 supports the H1 Foundation Fieldbus Communication Standard FF-003-2.2-1-1, Version 1.4. Additionally, all relevant parameters in the device are offered via the FF interface. The IFC 090 defines the following functional blocks:

- Three Function Blocks (FB): One Analog Input-FB for flow and two integrator-FBs for integration. Reset function is possible.
- One Transducer Block for electromagnetic flow measurement.
- One standard Resource Block.

3 Foundation Fieldbus Principles

The Foundation Fieldbus is a Local Area Network (LAN) for connecting field devices like sensors and actuators. One of the main benefits of Foundation Fieldbus is line saving in comparison to the traditional 4 ... 20 mA technology.

The different device functions are implemented in a block-based scheme within a User Application. In this block scheme, a distinction is made between the following kinds of blocks (see Figure 1):

- Resource Block,
- Transducer Block(s) and
- Function Block(s).

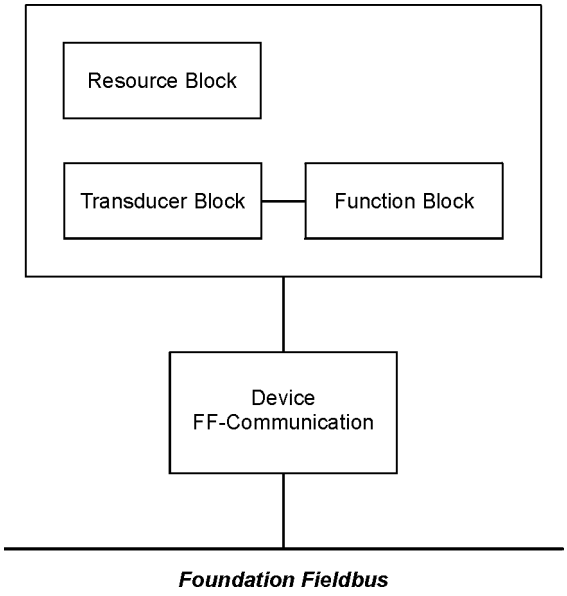


Figure 1: Foundation Fieldbus block scheme

3.1 Resource Block

Each FF device possesses exactly one Resource Block describing the specific features of the fieldbus device. The Resource Block is not related to any functional process of the device, but contains data that are specific for the device (e.g. device name, serial number, supported features, etc).

In addition, the Resource Block provides dynamic diagnostic data giving information on the current state of the hardware.

A basic set of Resource Block parameters is specified by Fieldbus Foundation (see FF-891, 3.1). This set can be extended by additional manufacturer specific parameters (the IFC090-FF possesses the Foundation specified parameters only).

3.2 Transducer Block

Transducer Blocks represent the interface between the device specific hardware (i.e. input/output functions) and the FF specified Function Block model. Since there might be multiple functions in a device (measurement values, positioning functions, etc), an FF device can have several Transducer Blocks1.

They provide device specific information in terms of sensor/actuator functions (e.g. type of sensor, range of process value, etc) and they make available the process values to the function blocks or provide the actuator input values obtained from function blocks to the hardware respectively.

3.3 Function Blocks

The main functional behavior of the FF device is implemented in one or several Function Blocks. Depending on the device type there are Input Blocks (e.g. flow device → Analog Input Block, Discrete Input, etc), Output Blocks (e.g. valve → Discrete Input, etc), or Control Blocks (PID, etc). These blocks have input and/or output parameters to be linked to other devices and to control systems by the Fieldbus.

[1] Note: This does not imply that an FF device has to have several Transducer Blocks if it provides several functions.

4 IFC090-FF Block Description

The IFC090-FF consists of the following blocks (see figure 2):

- 1 Resource Block,
- 1 Transducer Block (standard flow),
- 1 Analog Input Block (flow value) and
- 2 Integrator Blocks (1 for positive- and 1 for negative flow integration)

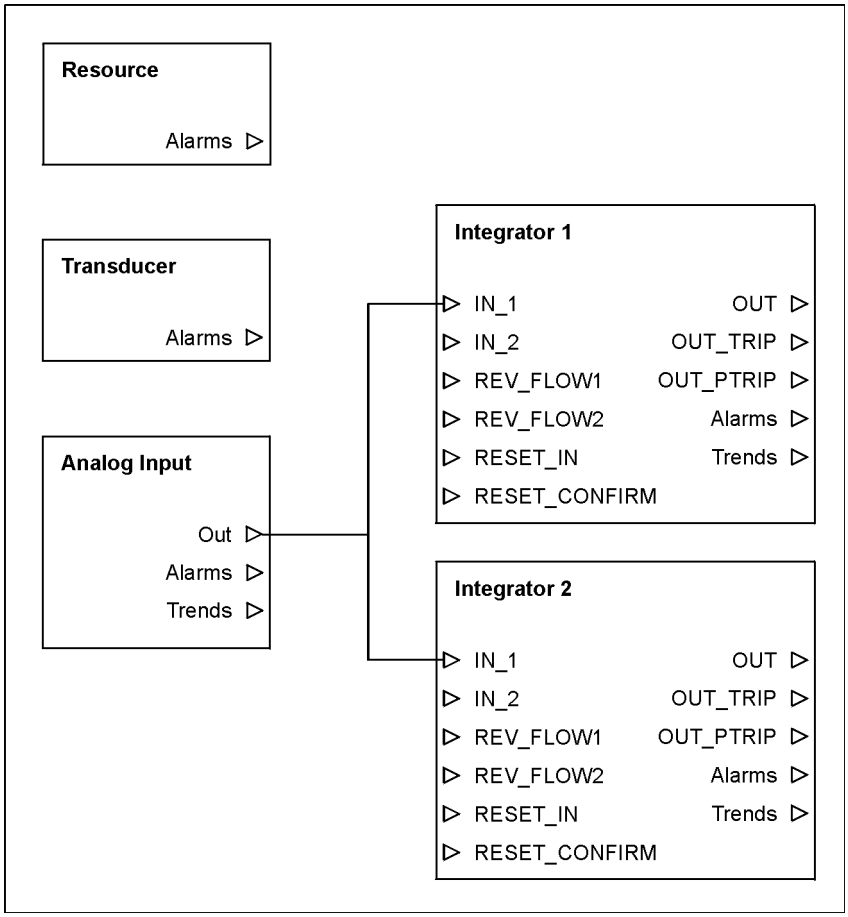


Figure 2: IFC090-FF block scheme

In the following, the different block parameters are described in detail.

4.1 Resource Block

Table 1 lists the Resource Block parameters in alphabetical order (this list provides a description of the various parameters only; for a more detailed description of how to configure these parameters: see chapter below.

Parameter	Access	Description
ACK_OPTION	R/W	Allows to enable automatic acknowledge of Resource Block alarms. The following settings are valid for Resource Block: Unack Alarm 1 (Discrete Alarm) clearing of soft write lock Unack Alarm 8 (Block Alarm) block mode switches to Out of Service If set, the respective alarm doesn't have to be acknowledged when occurring. see also: *ALARM_SUM*, *WRITE_LOCK*, *WRITE_ALM*
ALARM_SUM	Mix	Display of process alarms. The current alarm is displayed in the *current* field and can have the following values: Discrete Alarm the soft write lock was cleared Block Alarm block mode switches to Out of Service The additional fields *unacknowledged* and *unreported* give respective information about the current alarm state. The field *disabled*, which is the only writable field of this parameter, can be used to disable these alarms. see also: *ACK_OPTION*
ALERT_KEY	R/W	ALERT_KEY parameter contains the identification number of the plant unit. It helps to identify the location (plant unit) of an event. The handling of this parameter is up to the control system or control person, respectively.
BLOCK_ALM	R	Display of current block state. Field *subcode* gives information about the state current errors. The following errors can occur: Configuration Error Change in Simulation Jumper Local Override Device Fault State Memory Failure Lost Static Data Lost NV Data Power-up Block was put Out of Service The remaining fields give information about the state and the occurence of this alarm.
BLOCK_ERR	R	Display of active block errors. The following errors are possible: Out of Service block is in Out of Service mode Power-up power supply of IFC090-FF was interrupted Device needs Maintenance now fatal error of IFC090-FF hardware Memory Failure memory of device has errors Input Failure measurement value not o.k. Other any other hardware problem
CLR_FSTATE	R/W	Writing a Clear to this parameter will clear the device fault state if the field condition, if any, has cleared. **NOTE**: This parameter is not supported! see also: *FAULT_STATE*
CONFIRM_TIME	R/W	Time the resource waits for receipt confirmation of an earlier sent report, before trying to send a new one. If zero (0), no retry will be performed.

Parameter	Access	Description
CYCLE_SEL	R/W	Used to select the block execution method for this resource. The following methods are available: Scheduled Completion of block execution see also: *CYCLE_TYPE*
CYCLE_TYPE	R	Identifies the block execution methods available for this resource.
DD_RESOURCE	R	It is possible to deliver devices which have the DD for its resource within the device. This parameter assigns the tag where to find the DD in the resource. Since the IFC090-FF doesn't come with a 'build-in' DD, this value is blank.
DD_REV	R	Revision associated with the DD of the resource – used by interface devices to locate the DD file for the resource.
DEV_REV	R	KROHNE revision number associated with this resource – used by interface devices to locate the DD file for the resource.
DEV_TYPE	R	KROHNE model number of the IFC090-FF – used by interface devices to locate the DD file for the resource.
FAULT_STATE	R	Condition set by loss of communication to an output block. **NOTE**: Since the IFC090-FF doesn't have an output block, this parameter isn't supported.
FEATURES	R	Used to show supported resource block options. The following features are supported by the IFC090-FF: Reports Soft Write Lock see also: *FEATURE_SEL*
FEATURE_SEL	R/W	Used to select supported features. The following features are selectable: Reports enable sending of alert reports Soft Write Lock enable soft write locking of parameters see also: *FEATURE_SEL*
FREE_TIME	R	Available time for configuration of further blocks. **NOTE**: Since the IFC090 blocks are preconfigured, this value is always zero (0).
FREE_SPACE	R	Available memory for configuration of further blocks. **NOTE**: Since the IFC090 blocks are preconfigured, this value is always zero (0).
GRANT_DENY	R/W	Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block. **NOTE**: This parameter is not supported by IFC090-FF
HARD_TYPES	R	The type available input signal that is delivered by the Transducer Block and used as Analog Input Block input parameter. For the IFC090-FF this is 'Scalar Input' (1).
ITK_VER	R	Major revision number of the interoperability test case used in certifying this device as interoperable. **NOTE**: Due to an error, this value is '0', but has to be '4' (since the IFC090-FF is interoperable with interoperability test case version 4).
LIM_NOTIFY	R/W	Maximum number of unconfirmed alert notifies messages allowed. This number always has to be less than *MAX_NOTIFY*. see also: *MAX_NOTIFY*

Parameter	Access	Description
MANUFAC_ID	R	Manufacturer identification number. For KROHNE devices this is always $00012C_{16} = 300_{10}$ = KROHNE
MAX_NOTIFY	R	Maximum number of unconfirmed notifies messages possible. see also: *LIM_NOTIFY*
MEMORY_SIZE	R	Available configuration memory in the empty resource. **NOTE:** This parameter is not supported by IFC090.
MIN_CYCLE_T	R	Time duration of the shortest cycle interval of which the IFC090 is capable. Within this cycle all Function Blocks (1 Analog Input + 2 Integrators) have to be executed for one time.
MODE_BLK	Mix	Display of the current (actual), desired (*target*), possible (*permitted*) and *normal* modes of the Resource Block. By writing a permitted value to the target field, you can control the execution modes of the block. The following block modes are allowed for the IFC090-FF Resource Block: Automatic Mode (AUTO) In this mode, the complete resource is able to execute. All other blocks (Transducer, Analog Input, Integrator) can switch to a mode different from Out of Service) Out of Service (OOS) In this mode, the complete resource stops its execution. For the other blocks it is not possible to switch to AUTO mode, unless the Resource Block does. **NOTE:** Under certain conditions (e.g. RS_STATE = ONLINE_LINKING) the Resource Block is not capable of switching to AUTO mode. see also: *RS_STATE*
NV_CYCLE_T	R	Minimum time interval between two cycles of writing non-volatile parameters *OUT*, *PV* and *FIELD_VAL*. Since these values are not saved, this value is always zero (0) which means don't save these parameters.
RESTART	R/W	Allows a manual restart to be initiated. Several degrees of restart are possible: RUN — Setting for normal operation. RESTART RESOURCE — Warm start of the IFC090-FF. RESTART WITH DEFAULTS — Sets all FF parameters to their default values. **To be used with caution!** RESTART PROCESSOR — Cold start of IFC090 measurement electronics and warm start of FF process.
RS_STATE	R	State of the function block application state machine. The following states are possible: ONLINE — Normal operation state: All defined links are established. INITIALIZATION — Initialization state: All alarms will be confirmed and acknowledged. ONLINE-LINKING — Link evaluation state: Wait until all links are established STANDBY — Out of Service state: Entered if mode of Resource Block is OOS.
SET_FSTATE	R/W	Allows the Fault State conditions for output function blocks to be manually initiated by setting to 'Set'. **NOTE:** Since the IFC090-FF doesn't have an output block, this parameter is not supported.
SHED_RCAS	R/W	Time duration for the monitoring-cycle in which a function block in mode RCAS has to answer on control system requests. **NOTE:** Since the IFC090-FF has no function block capable of switching to mode RCas, this parameter is not supported.

Parameter	Access	Description
SHED_ROUT	R/W	Time duration for the monitoring-cycle in which a function block in mode Rout has to answer on control system requests. **NOTE:** Since the IFC090-FF has no function block capable of switching to mode Rout, this parameter is not supported.
STRATEGY	R/W	Parameter used to group a set of blocks. This is done by assigning the same STRATEGY numerical value to all blocks belonging to one group. **NOTE:** This parameter is neither checked nor used by the function block application! It can be used by control system to group blocks!
ST_REV	R	Static data revision counter. ST_REV will be incremented if a static Resource Block parameter has changed. By checking this parameter, control systems are able to realize if a static parameter has changed its value without checking all static parameters all the time.
TAG_DESC	R/W	User description of the intended application of the block. The user is free in setting this value. The only limitation is the length of 32 characters at maximum. It is not checked by the application, but has informational character only.
TEST_RW	R/W	Read/write test parameter. It is only used during Fieldbus Foundation interoperability testing and has no meaning for normal operation!
UPDATE_EVT	R	Alert generated by a change to static data. The subfields of this parameter give detailed information about the changed static parameter, time of change and state of the update event.
WRITE_ALM	R	Alarm generated, if the parameter write lock is cleared. see also: *ACK_OPTION, WRITE_LOCK, WRITE_PRI*
WRITE_LOCK	R/W	If this parameter is set to 'Locked' (2) all writable parameters in all blocks are write protected, with the exception of WRITE_LOCK itself. Dynamic data will continue to be updated. To disable the write protection, set this parameter to 'Not Locked' (1). see also: *ACK_OPTION, WRITE_ALM, WRITE_PRI*
WRITE_PRI	R/W	Priority of the alarm generated by clearing the WRITE_LOCK: 0 alarm isn't be evaluated 1 no notification to the control system in case of an write protection alarm 2 reserved for block alarms 3-7 write protection is send as user/operator note to the control system, according to the given priority (3 = low and 7 = high) 8-15 write protection alarm is sent with the appropriate priority (15 = high and 8 = low).

Table 1: Resource Block parameters

4.2 Transducer Block

Table 2 lists the Transducer Block parameters in alphabetical order (this list gives a description of the various parameters only; see chapter below. for a detailed description depicting how to configure these parameters):

Parameter	Access	Description
ALERT_KEY	R/W	Identification number of the plant unit. It helps to identify the location (plant unit) of an event. The handling of this parameter is up to the control system or control person, respectively.
BLOCK_ALM	R	Display of current block state. Field *subcode* gives information about the state current errors. The following errors can occur: Configuration Error Block was put Out of Service The remaining fields give information about the state and the occurrence of this alarm.
BLOCK_ERR	R	Display of active block errors. The following errors are possible: Out of Service — block is in Out of Service mode Device needs Maintenance now — fatal error of IFC090-FF hardware
CAL_MIN_SPAN	R	Minimum calibrated span value allowed.
CAL_POINT_HI	R/W	Highest calibrated value. This value depends on the IFC090-FF pipe diameter.
CAL_POINT_LO	R/W	Lowers calibrated value. This is the absolute value of the lowest positive and negative value, the device is capable of measuring, and it is constant to '0'.
CAL_UNIT	R/W	Engineering units code index for the calibration values. This is always m^3/s (cubic meter per second).
CAL_ZEROPOINT	R/W	Start zero point calibration by writing a value different from '0'. **NOTE:** Handle this parameter with caution, since a correct zero point calibration is based some important conditions.
COLLECTION_DIRECTORY	R	Directory that specifies the number, starting index, and DD[2] item IDs of the transducer block's data collections. The first entry specifies the number of data collections, and the remaining specifies the data collections.
CYCLES_ZEROPOINT_CAL	R/W	Number of cycles to perform if a zero point calibration is started. Valid values are in between 0 and 2000.
LIN_TYPE	R/W	Linearization type used to describe the behavior of the sensor output. The IFC090-FF has a linearization type of 'linear with input'.

[2] DD = Device Description

Parameter	Access	Description
MODE_BLK	Mix	Display of the current (*actual*), desired (*target*), possible (*permitted*) and *normal* modes of the Transducer Block. By writing a permitted value to the target field, you can control the execution modes of the block. The following block modes are allowed for the IFC090-FF Transducer Block: Automatic Mode (AUTO) In this mode, the transducer performs an automatic measurement update and delivers it via its channels to connected input blocks (normally, the integrated Analog Input Block) Manual (MAN) Different from the AUTO mode, the block doesn't perform an automatic delivery of valid measurement values, but freezes its primary value to the last one obtained in Auto mode. The *PRIMARY_VALUE* status switches to *Uncertain:NonSpecific:Constant*. Out of Service (OOS) In this mode, the transducer stops measurement update and sets the status of the measured value (*PRIMARY_VALUE*) to BadOutOfService:NotLimited. **NOTE:** If the Resource Block is in mode Out of Service, also the block will remain in this mode.
PRIMARY_VALUE	R	The measured value and status available to the Function Blocks.
PRIMARY_VALUE_RANGE	R	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	R/W	Type of sensor. The IFC090-FF is of type 'volumetric flow' (101). **NOTE:** Even though this parameter is writable, it does not accept a value different from 'volumetric flow' (101).
SECONDARY_VALUE	R	Normally, the secondary value, is related to the sensor. Since the IFC090-FF has no secondary value, this is fixed to status Bad:NonSpecific:NotLimited with value 0.0.
SECONDARY_VALUE_UNIT	R/W	Normally the units to be used for the *SECONDARY_VALUE*. Since the IFC090-FF has no secondary value, this is fixed to the unit of the primary value.
SENSOR_CAL_DATE	R/W	Date of last sensor calibration. If this is set '01/01/84 00:00:00' it means that the last calibration was that after production of device.
SENSOR_CAL_LOC	R/W	Location of last sensor calibration.
SENSOR_CAL_METHOD	R/W	Method of last sensor calibration. In the context of the ISO defined standard method of calibrations, KROHNE performed a 'factory trim standard calibration'.
SENSOR_CAL_WHO	R/W	Name of the person responsible for the last calibration.
SENSOR_RANGE	R	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. These values are equal to the one given for PRIMARY_VALUE_RANGE.
SENSOR_SN	R	Sensor serial number. Must be the same as on the nameplate of the device's housing.
SENSOR_TYPE	R/W	Type of sensor. For IFC090-FF this is fixed: 'Electromagnetic' (102) **NOTE:** Even though this parameter is writable, it does not accept a value different from 'Electromagnetic' (102).

Parameter	Access	Description
ST_REV	R	Static data revision counter. ST_REV will be incremented if a static Transducer Block parameter has changed. By checking this parameter, control systems are able to realize if a static parameter has changed its value without checking all static parameters all the time.
STRATEGY	R/W	Parameter used to group a set of blocks. This is done by assigning all blocks belonging to one group the same STRATEGY numerical value. **NOTE:** This parameter is neither checked nor used by the function block application! It can be used by control system to group blocks!
TAG_DESC	R/W	User description of the intended application of the block. The user is free in setting this value. The only limitation is the length of 32 characters at maximum. It is not checked by the application, but has informational character only.
TRANSDUCER_DIRECTORY	R	Directory that specifies the number and starting indices of the transducers in the transducer blocks. Since the IFC090-FF possesses only one transducer, the directory consists of one entry only (1 = number of transducers, 711 = starting index of the only transducer).
UPDATE_EVENT	R	Alert generated by a change to static data. The subfields of this parameter give detailed information about the changed static parameter, time of change and state of the update event.
XD_ERROR	R	Error code that is specific to the sensor hardware. If a profoundly hardware error is existent, this parameter shows the error 'Electronics failure' (20).

4.3 Analog Input Block (Flow)

Table 3 lists the Analog Input Block parameters in alphabetical order (this list gives a description of the various parameters only; see chapter below for a detailed description of how to configure these parameters):

Parameter	Access	Description
ACK_OPTION	R/W	Allows to enable automatic acknowledge of Analog Input Block alarms. The following settings are valid for Resource Block: Unack Alarm 1 (Discrete Alarm) — clearing of soft write lock Unack Alarm 2 (High High Alarm) — OUT value reaches the HI_HI_LIM Unack Alarm 3 (High Alarm) — OUT value reaches the HI_LIM Unack Alarm 4 (Low Low Alarm) — OUT value reaches the LOW_LOW_LIM Unack Alarm 5 (Low Alarm) — OUT value reaches the LO_LIM Unack Alarm 8 (Block Alarm) — block mode switches to Out of Service If set, the respective alarm don't has to be acknowledged on occurence see also: *ALARM_SUM*
ALARM_HYS	R/W	Amount the *OUT* value must return within the alarm limits before the alarm condition *(HI_HI_ALM; HI_ALM, LO_ALM, LOW_LOW_ALM)* clears. Alarm Hysteresis is expressed as percent of the *OUT_SCALE* span and is set 0.5% by default.

Parameter	Access	Description
ßALARM_SUM	R	Display of process alarms. The current alarm is displayed in the *current* field an can have the following values: Discrete Alarm — the soft write lock was cleared HiHi Alarm — the high limit alarm is active Hi Alarm — the high limit advance alarm is active Lo Alarm — the low limit advance alarm is active LoLo Alarm — the low limit alarm is active Block Alarm — block mode switches to Out of Service The additional fields *unacknowledged* and *unreported* give respective information about the current alarm state. The field *disabled*, which is the only writable field of this parameter, can be used to disable these alarms. see also: *ACK_OPTION*
ALERT_KEY	R/W	ALERT_KEY parameter contains the identification number of the plant unit. It helps to identify the location (plant unit) of an event. The handling of this parameter is up to the control system or control person, respectively.
BLOCK_ALM	R	Display of current block state. Field *subcode* gives information about the state current errors. The following errors can occur: Configuration Error Block was put Out of Service The remaining fields give information about the state and the occurrence of this alarm.
BLOCK_ERR	R	Display of active block errors. The following errors are possible: Out of Service — block is in *Out of Service* mode Input Failure — *SIMULATE.status* is *Bad:NonSpecific* Simulate Active — *SIMULATE.enable* = yes Block Configuration Error — channel unit != *XD_SCALE.unit*, or *CHANNEL* != 1, or *L_TYPE* is uninitalized
CHANNEL	R/W	Number of the transducer's logical hardware channel that is connected to this Analog Input block. The only valid value is '1' (since the Transducer has only one hardware channel). Every other value would cause an 'Block Configuration Error' which is displayed in BLOCK_ERR. The default value is '0'.
FIELD_VAL	R	Raw value of the field device in percent of the *PV* range, with a status reflecting the Transducer condition, before characterization (*L_TYPE*) or filtering (*PV_FTIME*). See 5.3.3 for details.
GRANT_DENY	R/W	Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block. **NOTE:** This parameter is not supported by IFC090-FF.
HI_ALM	R	With subject to the setting of *HI_PRI*, HI_ALM shows details about the high alarm as acknowledge state and time stamp. See *HI_PRI* for details. see also: *HI_PRI, HI_LIM*
HI_HI_ALM	R	With subject to the setting of *HI_HI_PRI*, *HI_HI_ALM* shows details about the high high alarm as acknowledge state and time stamp. See HI_HI_PRI for details. see also: *HI_HI_PRI, HI_HI_LIM*
HI_HI_LIM	R/W	The limit value in engineering units as of the *HI_HI_ALM* is active (with subject to *HI_HI_PRI*). see also: *HI_HI_PRI, HI_HI_LAM*

Parameter	Access	Description
HI_HI_PRI	R/W	Priority of the high high alarm that specifies the behavior if *OUT* reaches HI_HI_LIM. The following values are valid: 0 exceeding of high high limit isn't been evaluated 1 exceeding of high high limit is been evaluated, but acknowledgement isn't necessary 2-7 exceeding of high high limit is been evaluated and reported according to the given priority (2 = low priority, 7 = high priority). Status of OUT changes to Good(NC): UnackAdvisoryAlarmHighLimited. 8-15 exceeding of high high limit is been evaluated and reported according to the given priority (2 = low priority, 7 = high priority). Status of OUT changes to Good(NC): UnackCriticalAlarmHighLimited.
HI_LIM	R/W	The limit value in engineering units as of the *HI_ALM* is active (with subject to *HI_PRI*). see also: *HI_PRI, HI_LIM*
HI_PRI	R/W	Priority of the high alarm that specifies the behavior if *OUT* reaches HI_LIM. The following values are valid: 0 exceeding of high limit isn't been evaluated 1 exceeding of high limit is been evaluated, but acknowledgement isn't necessary 2-7 exceeding of high limit is been evaluated and reported according to the given priority (2 = low priority, 7 = high priority). Status of OUT changes to Good(NC):UnackAdvisoryAlarmHighLimited. 8-16 exceeding of high limit is been evaluated and reported according to the given priority (2 = low priority, 7 = high priority). Status of OUT changes to Good(NC):UnackCriticalAlarmHighLimited.
IO_OPTS	R/W	Options which the user may select to alter input and output processing of the Analog Input Block. The following option is supported by this block: Low cutoff The Analog Input low cutoff algorithm is enabled, i.e. if *PV* is less than *LOW_CUT*, *PV* is set to '0.0' see also: *LOW_CUT*
L_TYPE	R/W	Determines how the values, passed by the Transducer Block to the Analog Input Block, may be used. The following settings are valid: Direct values are used directly Indirect values are in different units and must be converted Indirect square root values are in different units and must be converted with square root. The conversion in case of 'Indirect' and 'Indirect square root' is determined by parameters *XD_SCALE* and *OUT_SCALE* (see for details). see also: *XD:SCALE, OUT_SCALE*
LO_ALM	R	With subject to the setting of *LO_PRI*, LO_ALM shows details about the high alarm as acknowledge state and time stamp. See *LO_PRI* for details. see also: *LO_PRI, LO_LIM*

Parameter	Access	Description
LO_LIM	R/W	The limit value in engineering units as of the *LO_ALM* is active (with subject to *LO_PRI*). see also: *LO_PRI, LO_LAM*
LO_LO_ALM	R	With subject to the setting of *LO_LO_PRI*, LO_LO_ALM shows details about the high alarm as acknowledge state and time stamp. See *LO_LO_PRI* for details. see also: *LO_LO_PRI, LO_LO_LIM*
LO_LO_LIM	R/W	The limit value in engineering units as of the *LO_LO_ALM* is active (with subject to *LO_LO_PRI*). see also: *LO_LO_PRI, LO_LO_LAM*
LO_LO_PRI	R/W	Priority of the low alarm that specifies the behavior if *OUT* reaches LO_LO_LIM. The following values are valid: 0 exceeding of low limit isn't been evaluated 1 exceeding of low limit is been evaluated, but acknowledgement isn't necessary 2-7 exceeding of low limit is been evaluted and reported according to the given priority (2 = low priority, 7 = high priority). Status of OUT changes to Good(NC):UnackAdvisoryAlarm:LowLimited. 8-17 exceeding of low limit is been evaluated and reported according to the given priority (2 = low priority, 7 = high priority). Status of OUT changes to Good(NC): UnackCriticalAlarm:LowLimited.
LO_PRI	R/W	Priority of the low low alarm that specifies the behavior if *OUT* reaches *LO_LIM*. The following values are valid: 0 exceeding of low low limit isn't been evaluated 1 exceeding of low low limit is been evaluated, but acknowledgement isn't necessary 2-7 exceeding of low low limit is been evaluted and reported according to the given priority (2 = low priority, 7 = high priority). Status of OUT changes to Good(NC):UnackAdvisoryAlarm:LowLimited. 8-18 exceeding of low low limit is been evaluated and reported according to the given priority (2 = low priority, 7 = high priority). Status of OUT changes to Good(NC):UnackCriticalAlarm:LowLimited.
LOW_CUT	R/W	Limit used if option *'Low cutoff'* is set (see *IO_OPTS* for details). A value of zero percent of scale is used in block processing if the transducer value falls below the LOW_CUT limit. This feature may be used to eliminate noise near zero for a flow sensor.

Parameter	Access	Description
MODE_BLK	Mix	Display of the current (*actual*), desired (*target*), possible (*permitted*) and *normal* modes of the Analog Input Block. By writing a permitted value to the target field, you can control the execution modes of the block. The following block modes are allowed for the IFC090-FF Analog Input Block: Automatic Mode (AUTO) In this mode, the Analog Input Block performs its functional computations in accordance with its configuration automatically. Measurement value deliverance and alarm handling are active. Manual (MAN) In difference to AUTO mode, the block doesn't perform an automatic deliverance of valid measurement values, but freezes the measurement to the last one obtained in Auto mode. The *OUT* status limit switches to constant. In this mode it is possible to write to the *OUT* value an arbitrary value to test blocks that use this *OUT* value as input. The alarm model works in the same way as in Auto mode. Out of Service (OOS) In this mode, the Analog Input Block stops its execution. No valid measurement value will be delivered, what can be seen at the status of *OUT (Bad:OutOfService:NotLimited)*.
OUT	R/W	The primary analog value and status calculated as a result of executing the block. In Auto mode of this block, the value and its status is automatically calculated on the base of the channel value obtained from the Transducer Block and calculation methods of the Analog Input Block. In Man mode it is possible to write to this value to specify a known, given value that can be used to test the correct operation of other downstream function blocks.
OUT_SCALE	R/W	Together with parameter *XD_SCALE*, OUT_SCALE is one of the two main scaling parameters. It can't be seen isolated. These two parameters specify a mapping function from the channel value obtained from the. See 5.3.2 for details.
PV	R	Value and status of the process value with same unit as *OUT_SCALE*. PV is the result after performing the linearization (see *L_TYPE*), the low cutoff (see *LOW_CUT, IO_OPTS*) and the filtering (see *PV_FTIME*).
PV_FTIME	R/W	Time constant of the single exponential filter for the *PV* in seconds.
SIMULATE	R/W	Normally, SIMULATE is used to perform a channel value and status simulation, i.e. instead of using the channel value obtained from the Transducer Block, the user would be able to simulate a distinct (constant) value and status as it comes from the Transducer. This is intensively used while interoperability testing at the Fieldbus Foundation. Since it has no practical use, this parameter isn't supported by the IFC090-FF.
ST_REV	R	Static data revision counter. ST_REV will be incremented if a static Analog Input Block parameter has changed. By checking this parameter, control systems are able to realize if a static parameter has changed its value without checking all static parameters all the time.

Parameter	Access	Description
STATUS_OPTS	R/W	STATUS_OPTS specifies how the *OUT* value status has to be set. If no status option is selected, the channel value status is used. Otherwise, the *OUT* status is set subject to the following possible status options: Uncertain if Limited — Set the *OUT* status to Uncertain if if the channel value is limited. BAD if Limited — Set the *OUT* status to *BAD* if the channel value is limited. Uncertain if Man mode — Set the *OUT* status to *Uncertain* if the actual mode of the Analog Input Block is Man. Otherwise the channel status would be used with constant limit.
STRATEGY	R/W	Parameter used to group a set of blocks. This is done by assigning all blocks belonging to one group the same STRATEGY numerical value. **NOTE**: This parameter is neither checked nor used by the function block application! It can be used by control system to group blocks!
TAG_DESC	R/W	User description of the intended application of the block. The user is free in setting this value. The only limitation is the length of 32 characters at maximum. It is not checked by the application, but has informational character only.
UPDATE_EVT	R	Alert generated by a change to static data. The subfields of this parameter give detailed information about the changed static parameter, time of change and state of the update event.
XD_SCALE	R/W	Together with parameter *OUT_SCALE*, XD_SCALE is one of the two main scaling parameters. It can't be seen isolated. These two parameters specify a mapping function from the channel value obtained from the. See 5.3.2 for details. **NOTE**: Since the Transducer Block parameter *PRIMARY_VALUE* has a fixed, not changeable unit, and the unit of XD_SCALE has to match meet the unit of this parameter. It is possible to change the unit of XD_SCALE but this would result in a *BLOCK_ERR* of *'Block Configuration Error'* and associated *OUT* value status.

Table 3: Analog Input Block parameters

4.4 Integrator Blocks 1 and 2 (Flow(+)- and Flow(-)-Totalizer)

Table 4 lists the Integrator Blocks parameters in alphabetical order (this list gives a description of the various parameters only; see chapter below for a detailed description of how to configure these parameters). The descriptions are valid for both Integrators, 'Flow(+) Totalizer' and 'Flow(-) Totalizer' unless expressively pointed out:

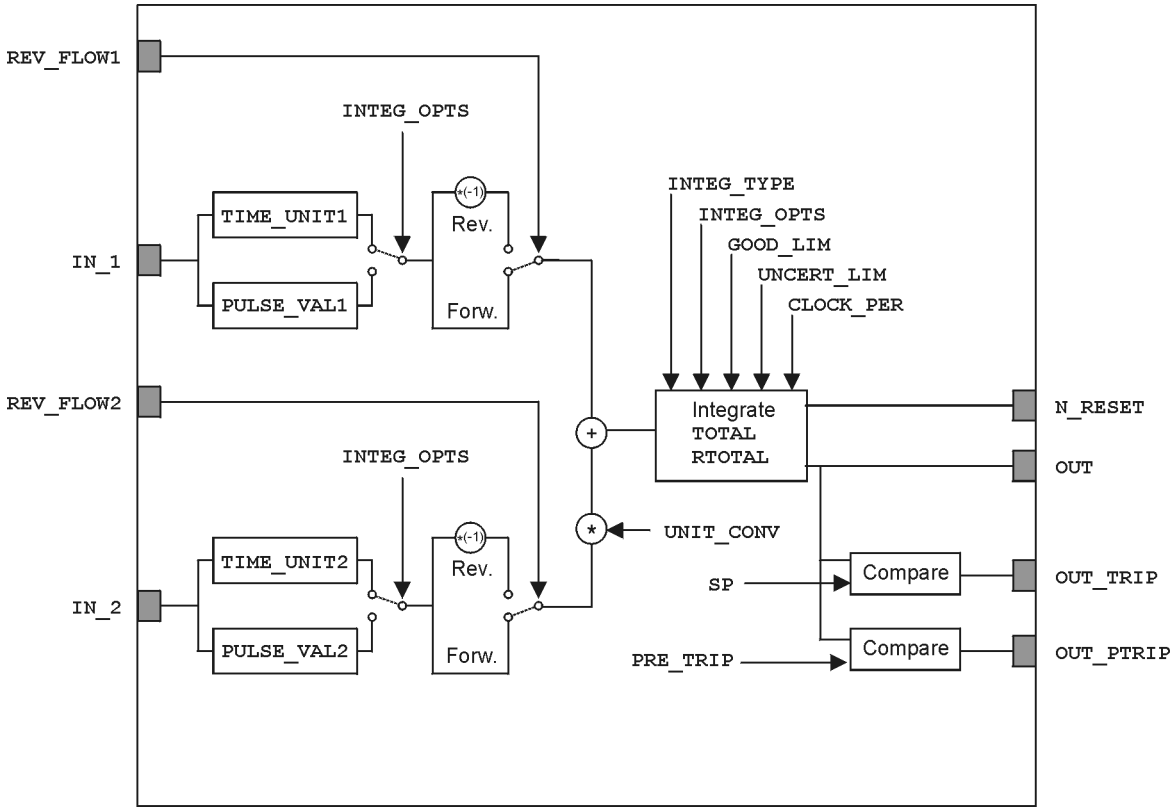


Figure 2: IFC090-FF Integrator Block

Parameter	Access	Description
ALERT_KEY	R/W	ALERT_KEY parameter contains the identification number of the plant unit. It helps to identify the location (plant unit) of an event. The handling of this parameter is up to the control system or control person, respectively.
BLOCK_ALM	R	Display of current block state. Field *subcode* gives information about the state current errors. The following errors can occur: Configuration Error Block was put Out of Service The remaining fields give information about the state and the occurrence of this alarm.
BLOCK_ERR	R	Display of active block errors. The following errors are possible: Out of Service — block is in Out of Service mode Memory Failure — memory of device has errors

Parameter	Access	Description
CLOCK_PER	R/W	CLOCK_PER specifies the time after which the Integrator *OUT* value should be reset, if parameter *INTEG_TYPE* is set to *'Periodic'*. see also: *INTEG_TYPE*
GOOD_LIM	R/W	GOOD_LIM specifies the limit for *Good* status of parameter *OUT*. If the percentage of *Good* input gets below this limit (and above *UNCERT_LIM*), the status of *OUT* turns from *Good* to *Uncertain* (unless GOOD_LIM equals *UNCERT_LIM*). see also: *UNCERT_LIM*
GRANT_DENY	R/W	Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block. **NOTE:** This parameter is not supported by IFC090-FF
IN_1	R	Primary block input with status coming (normally) from another block's output parameter. see also: *IN_2*
IN_2	R	Secondary block input with status, coming (normally) from another block's output parameter. see_also: *IN_1*
INTEG_OPTS	R/W	INTEG_OPTS is to be used to specify several integration options as type of input used in each input, flow direction to be considered in the totalization, status to be considered in the totalization and if the totalizatiion residue shall be used in the next batch after a reset. The following INTEG_OPTS are possible: Input 1 accumulate — IN_1 is used as pulse (otherwise as rate) Input 2 accumulate — IN_2 is used as pulse (otherwise as rate) Flow forward — only positive net flow will be taken into account for totalization (**NOTE**: *default settig for Integrator 1*) Flow reverse — only negative net flow will be taken into account for totalization (**NOTE:** *default settig for Integrator 2*) Use Uncertain — *IN_1* and *IN_2* input will be taken into account even if their states are *Uncertain* (otherwise the value with the last *Good* status will be taken) Use BAD Input — *IN_1* or *IN_2* with *BAD* status will be interpreted as *Good* (NOTE: only the status is interpreted as *Good*, the value isn't used for totalization, but the good one, i.e. *RTOTAL* isn't affected with this setting. Carry — integration after a reset starts with the init value, but with the residual after the trip value. Add zero if Bad — If one of the input (*IN_1* or *IN_2*) statuses are *BAD*, not the last *Good* value is used for totalization, but zero (0). Confirm reset — after a manual reset of totalization, the next manual reset must be preceded by a reset confirmation by the control system. Generate reset event — in case of reset (automatic or manual), an event notification will be sent to the control system. see also: INTEG_*TYPE*

Parameter	Access	Description
INTEG_TYPE	R/W	INTEG_TYPE defines the type of counting (up or down) and the type of resetting the totalization. The following types are available: Up auto — Totalization starts with 0.0 and counts up with automatic reset if *TOTAL_SP* is reached. Up demand — Totalization starts with 0.0 and counts up. A reset isn't performed except either a reset is initiated by *RESET_IN* or *OP_CMD_INT*. Down auto — Totalization starts with *TOTAL_SP* and counts down with automatic reset if 0.0 is reached. Down demand — Totalization starts with *TOTAL_SP* and counts down. A reset isn't performed except a reset is initiated either by *RESET_IN* or *OP_CMD_INT*. Periodic — Totalization starts with 0.0 and counts up. A automatic reset is performed in accordance to the time given in parameter *CLOCK_PER* (**NOTE:** *RESET_IN* and *OP_CMD_INT* resets are disabled and would produce a *'Wrong Mode For Request'* error). Demand — Totalization starts with 0.0 and counts up. To perform a reset, the operator has to write *'reset'* to parameter *OP_CMD_INT*. Periodic & Demand — Same as *'Periodic'* with the exception that *RESET_IN* and *OP_CMD_INT* resets are possible. see also: *RESET_*IN*, OP_CMD_INT, N_RESET*
MODE_BLK	Mix	Display of the current (*actual*), desired (*target*), possible (*permitted*) and *normal* modes of the Integrator Block. By writing a permitted value to the target field, you can control the execution modes of the block. The following block modes are allowed for the IFC090-FF Integrator Block: Automatic Mode (AUTO) In this mode, the Integrator Block performs its functional computations in accordance with its configuration automatically. Totalization is active. Manual (MAN) In difference to AUTO mode, the block doesn't perform an automatic totalization, but freezes the totalization value to the last one obtained in Auto mode. The *OUT* status limits switches to constant. In this mode it is possible to write to the *OUT* value an arbitrary value to test blocks that use this *OUT* value as input. Out of Service (OOS) In this mode, the Integrator Block stops its execution. No totalization is performed, what can be seen at the status of *OUT (Bad:OutOfService:NotLimited)*.
N_RESET	R	Counts the number of totalization resets. The counter provides verification that the totalization don't has been reset since it was last checked.
OP_CMD_INT	R/W	Setting this parameter to reset performs a totalization reset according to the chosen integration type (see parameter *INTEG_TYPE* for details). see also: *INTEG_TYPE*
OUT	R/W	The totalization value and status calculated as a result of executing the block. In Auto mode of this block, the value and its status is automatically calculated on the base of the calculation methods of the Integrator Block. In Man mode it is possible to write to this value to specify a known, given value that can be used to test the correct operation of other downstream function blocks.

Parameter	Access	Description
OUT_PTRIP	R/W	Second discrete output. OUT_PTRIP can be used within a control system, to get a discrete indication, that a specified value of totalization is reached (e.g. as indication to start closing a valve). The specified value to reach can be set in parameter PRE_TRIP. **NOTE**: If the totalization reaches *PRE_TRIP*, *OUT_PTRIP* is set to 255 (0xFF). see also: *PRE_TRIP, OUT_TRIP*
OUT_RANGE	R	Display scaling of the output OUT. It has no effect on the block and is used by downstream blocks or control system to get the unit of the totalization.
OUT_TRIP	R/W	Second discrete output. OUT_TRIP can be used within a control system, to get a discrete indication, that the specified value of totalization for resetting (automatic reset is selected) is reached. The specified value to reach can be set in parameter *TOTAL_SP*. see also: TOTAL_*SP, OUT_PTRIP*
OUTAGE_LIM	R/W	Maximum tolerable time for power failure. Not used by the IFC090-FF
PCT_INCL	R	Percentage of *BAD* and *Uncertain* net flow values used in conjunction with *GOOD_LIM* and *UNCERT_LIM* to determine the status of the output value *OUT*. It is calculated by the following equation: PCT_INCL = 100 * (1 - (rtotal / atotal), where *rtotal* is the portion of *BAD* and *Uncertain* net flows and *atotal* the absolute value of all net flows. see also: *GOOD_LIM, UNCERT_LIM*
PRE_TRIP	R/W	When integration is counting up (see *INTEG_TYPE*) and the totalization value equals or exceeds (*TOTAL_SP* - *PRE_TRIP*) then the discrete output *OUT_PTRIP* is set to 0xFF. If counting down and the value of *OUT* is equal to or less than *PRE_TRIP*, the discrete output *OUT_PTRIP* is set to 0xFF. see also: *OUT_PTRIP*
PULSE_VAL1	R/W	PULSE_VAL1 specifies the factor by witch *IN_1* is to be multiplied if *IN_1* is used as input of accumulated pulses (i.e. *'Input 1 accumulate'* is set in *INTEG_OPTS*). In this respect, *IN*_1 will be converted according to the following equation: IN_1 = IN_1 * PULSE_VAL1
PULSE_VAL2	R/W	PULSE_VAL2 specifies the factor by witch *IN_2* is to be multiplied if *IN_2* is used as input of accumulated pulses (i.e. *'Input 1 accumulate'* is set in *INTEG_OPTS*). In this respect, IN_2 will be converted according to the following equation: IN_2 = IN_2 * PULSE_VAL2
RESET_CONFIRM	R/W	RESET_CONFIRM can be used by control systems to confirm a reset event report if *'Confirm reset'* is set in *INTEG_OPTS*.
RESET_IN	R/W	RESET_IN can be used by control systems to reset the totalization by an external signal. By setting *'value'* to *'Reset'* (0x01) and a status of *GoodNC:NS:NL*, the integrator will be reset as if *OP_CMD_INT* was set to *'Reset'*. see also: *OP_CMD_INT, INTEG_TYPE*

Parameter	Access	Description
REV_FLOW1	R/W	REV_FLOW1 can be used to indicate a reverse *IN_1* flow. If *IN_1* flow is positive (i.e. forward flow), setting this parameter to a value not equal to *'Discrete state 0'* (0), will result in the same but negative value (i.e. multiplication by (-1)). **NOTE:** If 'Forward flow' is selected in *INTEG_OPTS* (which is the default for Integrator Block 1) the resulting net flow will always be 0.0 for negative net flows! *If 'Reverse flow'* is selected in *INTEG_OPTS* (which is the default for Integrator 2) the resulting net flow will always be 0.0 for positive flows!
REV_FLOW2	R/W	REV_FLOW2 can be used to indicate a reverse *IN_2* flow . If *IN_2* flow is positive (i.e. forward flow), setting this parameter to a value not equal to *'Discrete state 0'* (0), will result in the same but negative value (i.e. multiplication by (-1)). **NOTE:** If 'Forward flow' is selected in *INTEG_OPTS* (which is the default for Integrator Block 1) the resulting net flow will always be 0.0 for negative net flows! If *'Reverse flow'* is selected in *INTEG_OPTS* (which is the default for Integrator 2) the resulting net flow will always be 0.0 for positive flows!
RTOTAL	R	RTOTAL stands for *'rejects total'* and integrates the net flow values with status *BAD* (if *'Use BAD'* is not set in *INTEG_OPTS*) and Uncertain (if *'Use Uncertain'* is not set on *INTEG_OPTS*) and is used to calculate the parameter *PCL_INCL* (see *PCL_INCL* for details). see also: *PCL_INCL*
SRTOTAL	R	SRTOTAL stands for *'snapshot RTOTAL'* and displays the value of *RTOTAL* just before the last reset (if one has happened, inspect *N_RESET* to see if one has happen). The initial value is set to zero (0).
SSP	R	SSP stands for *'snapshot TOTAL_SP'* and displays the value of *TOTAL_SP* just before the last reset (if one has happened). The initial value is set to zero (0).
ST_REV	R	Static data revision counter. ST_REV will be incremented if a static Integrator Block parameter has changed. By checking this parameter, control systems are able to realize if a static parameter has changed its value without checking all static parameters all the time.
STATUS_OPTS	R/W	STATUS_OPTS specifies how the *OUT*, *OUT_TRIP* and *OUT_PTRIP* status has to be set. If no status option is selected, the status is the result from the block's operation. Otherwise, the status is set subject to the following possible status option: Uncertain if Man mode — Set the *OUT*, *OUT_TRIP* and *OUT_PTRIP* status to *Uncertain* if the actual mode of the Integrator Block is *Man*.
STOTAL	R	STOTAL stands for *'snapshot TOTAL'* and displays the value of the totalization (= *OUT*) just before a reset (if one has happened). The initial value is set to zero (0).
STRATEGY	R/W	Parameter used to group a set of blocks. This is done by assigning all blocks belonging to one group the same STRATEGY numerical value. **NOTE**: This parameter is neither checked nor used by the function block application! It can be used by control system to group blocks!
TAG_DESC	R/W	User description of the intended application of the block. The user is free in setting this value. The only limitation is the length of 32 characters at maximum. It is not checked by the application, but has informational character only.

Parameter	Access	Description
TIME_UNIT1	R/W	TIME_UNIT_1 specifies the time unit of IN_1, if IN_1 comes from a pulse input block (i.e. *'Input 1 accumulate'* is set in INTEG_OPTS) and converts the input IN_1 according to one of the following time unit: *s* second *min* minute *h* hour *d* day
TIME_UNIT2	R/W	TIME_UNIT_2 specifies the time unit of *IN_2*, if *IN_2* comes from a pulse input block (i.e. *'Input 2 accumulate'* is set in *INTEG_OPTS*) and converts the input *IN_2* according to one of the following time unit: *s* second *min* minute *h* hour *d* day
TOTAL_SP	R/W	Setpoint for batch totalization. Meaning depends on the chosen type of integration. (see *INTEG_TYPE* for details). see also: INTEG_*TYPE*
UNCERT_LIM	R/W	UNCERT_LIM specifies the limit for *Uncertain* status of parameter *OUT*. If *PCT_INCL* gets below this limit, the status of parameter *OUT* turns from *Uncertain* to *BAD* (unless *GOOD_LIM* equals *UNCERT_LIM*): UNCERT_LIM ≤ PCT_INCL ⇒ OUT.status = Uncertain PCT_INCL < UNCERT_LIM ⇒ OUT.status = BAD see also: *GOOD_LIM*
UNIT_CONV	R/W	UNIT_CONV is used as a factor to convert the engineering units of *IN_2* into the engineering units of *IN_1*, after *IN_2* was converted according to it's time unit. This is only true, if *IN_2* is connected to another output parameter! **NOTE:** This is necessary since in the integration process, the (converted) inputs *IN_1* and *IN_2* are added which presupposes a common unit base.
UPDATE_EVT	R	Alert generated by a change to static data. The subfields of this parameter give detailed information about the changed static parameter, time of change and state of the update event.

Table 4: Integrator Blocks parameters

5 IFC090-FF Configuration

5.1 Resource Block Configuration

This block contains the data associated with the underlying resource, i.e. data that are specific to the hardware. It describes characteristics of the fieldbus device (e.g. device name, serial number, etc.) and is not included in the functional tasks of the IFC090-FF. Thus, it consists of contained parameter3 only. As a rule, the configurable items of the Resource Block are not used to modify a special detail, but the representation and behavior of the complete device.

5.1.1 Resource Block Mode Handling

Since the Resource Block is characterizing the fieldbus device as a whole, its operation mode also affects the complete IFC090-FF. To this end, the Resource Block supports the following operation modes

- Automatic (Auto), and
- Out of Service (OOS).

In Automatic mode, the complete Resource (i.e. Transducer and Function blocks) is able to operate and perform their functional tasks. In the Out of Service mode, all other blocks are in Out of Service mode, too, and are not capable of changing their mode unless the Resource block is set to to Automatic mode.
If a block is in Out of Service mode, this is also indicated by its BLOCK_ERR parameter.

5.1.2 Write Protection

Normally, all (writable) parameters of all blocks are not protected against accidental write accesses. To avoid such accidental write accesses you can use the IFC090-FF building software write lock. This write lock can be controlled by the parameter WRITE_LOCK, which can have the following settings:

- *Not locked* (numerical value: 1), or
- *Locked* (numerical value: 2).

If set to Locked, all writable parameters (with the exception of parameter WRITE_LOCK itself) are write protected until the write lock is cleared (i.e. set to Not locked).
If the control system should be notified by an alarm, if the write lock is cleared, this can be controlled by the parameter WRITE_PRI. This parameter expects a numerical value which specifies the behavior of the write lock clearing alarm parameter WRITE_ALM. Subject to the following settings of WRITE_PRI, WRITE_ALM behaves as follows:

[3] A parameter is called *"contained"* if it not use other blocks output parameters or can not be used by other blocks input parameters, respectively.

WRITE_PRI	Behavior of WRITE_ALM
0	No alarm is been generated in *WRITE_ALM*
1	Alarm is been generated in *WRITE_ALM*, but the control system won't be notified about it.
2	reserved for block alarms
3-7	Clearing of write protection is sent as user/operator note to the control system, according to the specified priority (3 = low and 7 = high).
8-15	Clearing of write protection is sent as alarm to the control system, according to the specified priority (3 = low and 7 = high).

5.1.3 Resource State Re-Initialization

The resource consists of a state machine which reflects the current state of the FF specific part of the IFC090-FF. This state is displayed in the Resource Block parameter RS_STATE and can have the following settings:

RS_STATE	Description
ONLINE	This is the normal operation state. All FF links are established and the resource works in automatic mode
INITIALIZATION	Resource's initialization state. This state will be passed if the device is connected with the fieldbus. All FF specific parts will be initialized with respect to saved configuration
ONLINE LINKING	In this state, all parameters are initialized and the device is waiting for the links are all established.
STANDBY	This state reflects, that all initializations are made, but the Resource Block is in *Out of Service* mode.

In some situations it could be necessary to restart or re-initialize some portions of the device (due to a completely wrong configuration, etc.). To perform this, some degrees of reset/re-initialization are supported by the Resource Block parameter RESTART. Assigning a special value to this parameter, it is possible to enforce re initializations as described in the following table:

RESTART	Description
Run	Setting for normal operation.
Restart Resource	Warm start of the IFC090-FF measurement electronics.
Restart with Defaults	Sets all FF parameters to their factory default values. **NOTE: To be used with caution!**
Restart Processor	Cold start of the IFC090-FF measurement electronics and warm start of the FF specific application.

5.2 Transducer Block Configuration

The Transducer Block as interface between the device specific measurement hardware and the Fieldbus Foundation specified Function Block model, decouples the sensor output functions required to read the measurement value from the Function Blocks. Therefore, the Transducer Block is also based on contained parameters only, but provides its measurement value in a channel based scheme to the Function Blocks.

Since most of the Transducer Block parameters are depending on device settings which are configurable over the device's display only, there are not many what the user has to configure.

5.2.1 Transducer Block Mode Handling

As in other blocks the mode handling in the Transducer Blocks can be controlled by the parameter MODE_BLK. The Transducer Block supports the following modes:

- Automatic (AUTO),
- Manual (MAN), and
- Out of Service (OOS)

In Automatic mode, the Transducer operates in its standard way and delivers its measurement value and status as parameter PRIMARY_VALUE via channel 1 to the Function Blocks4 (if any).
Different from the Automatic mode, in Manual mode the Transducer Block freezes its measurement value and sets its status to Uncertain:NonSpecific Constant.
To stop the complete operation of the Transducer Block, set its mode to Out of Service. In this mode, the Transducer Block freezes its measurement value to the last one obtained in Automatic mode and sets its status to BAD:OutOfService:NonSpecific.
If the block is in Out of Service mode, this is also indicated by its BLOCK_ERR parameter.

5.2.2 IFC090-FF Zero Point Calibration

The Transducer Block allows a calibration of the devices zero point.
To do this, the number of calibration cycles has to be specified first by setting parameter CYCLES_ZEROPOINT_CAL (default value is 250).
To start the zero point calibration, parameter CAL_ZEROPOINT has to be set to a value different to zero (0).

5.3 Analog Input Block Configuration

The Analog Input block is one of the 3 Function Blocks supported by the IFC090-FF. It can be used to process the measurement value obtained from the Transducer Block in a user defined way and to deliver it to the control system. To this end, there are some parameters in the Analog Input Block, that can be configured to get a measurement value quality as desired by the user.
Analog Input Block Mode Handling
By selecting the operation mode in parameter MODE_BLK, the operator is able to control the activities of the Analog Input block. The following lists the available modes and meanings:

[4] Normally, this is the Analog Input block, but it has to be configured to process the channel value.

Analog Input block MODE_BLK	Description
Automatic (AUTO)	The Analog Input block performs its functional computations in accordance to its configuration automatically. Measurement deliverance and alarm handling are active
Manual (Man)	The block doesn't perform an automatic deliverance of valid measurement values, but freezes the measurement processing to the last value obtained in Automatic mode. The OUT status limit switches to 'Constant'. In this mode it is possible to write to the OUT value an arbitrary value to test blocks that use this OUT value as input. The alarm model works in the same way as in Automatic mode.
Out of Service (OOS)	The block stops its operation and freezes its measurement value to the last one obtained in Automatic mode. The OUT status switches to BAD:OutOfService:NonSpecific.

5.3.1 Process Value Selection

By selecting the channel of the Transducer Block, the operator determines which value should be used as Analog Input block input value. The value received over this channel is the base of the measurement value processing.

Since the Transducer Block of the IFC090-FF consists of one channel only, the Analog Input block parameter CHANNEL must be set to '1' to configure the Analog Input block for processing the IFC090-FF flow value.

If parameter CHANNEL is set to a different value than 1, the Analog Input parameter will display a 'BlockConfigurationError' in parameter BLOCK_ERR. The block isn't able to set the actual mode to Automatic.

5.3.2 Linearization and Scaling

The Transducer Block delivers the IFC090-FF measurement value in units of m3/s statically. If this is the unit that should be passed to the control system, no linearization is necessary and hence parameter L_TYPE has to be set to 'Direct'. Otherwise, the parameter has to be set with respect to the following kinds of scaling:

Direct

No linearization. The channel value obtained from the Transducer is used as it came in m3/s.

This presumes that XD_SCALE equals to OUT_SCALE, otherwise a 'Block Configuration Error' will be displayed in BLOCK_ERR.

Indirect

Linear conversion. The channel value obtained from the Transducer will be mapped from the input scaling (XD_SCALE) to the output scaling (OUT_SCALE).

Example:

Assumptions:

- Transducer Block delivers channel value in unit m3/s
- Analog Input Block should deliver values in unit liter/s
- 1 m3 = 1000 liter

Parameter calculation:

EUat100[XD_SCALE] = 100.0

EUat0[XD_SCALE] = 0.0

UnitsIndex[Units Index] = m3/s

EUat0[OUT_SCALE] = 0.0

UnitsIndex[OUT_SCALE] = liter/s

⇒ EUat100[OUT_SCALE] = (100.0 * 1,000) = 100,000.0

Indirect Square Root

Square root conversion. Takes the square root of the value computed by applying the input scaling (XD_SCALE) to the value obtained from the Transducer and maps the result to the output scaling (OUT_SCALE).

5.3.3 Filtering

The parameter PV_FTIME can be used to flatten the output value OUT in case of rapid changes in the channel value obtained from the Transducer. The higher the value in PV_FTIME in unit seconds, the slower the rise in the output value. If PV_FTIME is set to 0, no filtering will be performed.

Important Note:

Applications with pulsating flow as well with rapid changes in flowrate may require special settings in order to smooth and stabilize the flow as indicated in the display (see section 6.4 and 6.5 of the IFC090 Installation and Operating Instruction)

The flow input value for the FF module is based on that smoothed flow value indicated in the display (beginning with Device Series No. 429 861). When making use of the PV_FTIME parameter in the AI Block, you should be aware that there are two filters in series (filter in the device and filter AI Block).

5.3.4 Input/Output Options

The Fieldbus Foundation specification provides some different options for affecting the in- and outputs of Function Blocks in parameter IO_OPTS. But only one of these options is applicable to an Analog Input Block: “Low cutoff”.

If the Low Cutoff option is enabled and the converted block’s input value (PV) is below the limit specified by parameter LOW_CUT, a value of zero (0) is used for the PV.

This is useful to eliminate leak flow volumes around zero.

5.3.5 Output Status Options

The status value of the output OUT offers valuable clues to the quality of the measurement value. While this status most extensive depends on the state of the measurement electronics and the measurement process itself. By setting some of the following options in parameter STATUS_OPTS, the user is able to give this status an own interpretation on a small scale:

STATUS_OPTS	Description
Uncertain if Limited	Sets the OUT status to Uncertain if the channel value is limited or one of the alarm limits are exceeded.
BAD if Limited	Sets the OUT status to BAD if the channel value is limited or one of the alarm limits are exceeded.
Uncertain if Man mode	Sets the OUT status to Uncertain if the current mode of the Analog Input Block is Manual (Man). NOTE: If this option isn't enabled, the status of the channel value is used with constant limit.

The alarm limits mentioned in the former table refer to the alarms specified by the parameters HI_HI_LIM/HI_HI_PRI, HI_LIM/HI_PRI, LOW_LIM/LOW_PRI, and LOW_LOW_LIM/LOW_LOW_PRI (see 5.3.6)

5.3.6 Process Alarms

In most flow measurement applications, there are certain measurement values that can cause problems, e.g. a high limit (within the devices range) that may not be exceeded, otherwise other downstream devices could be damaged, or a low limit that may not be remain below, otherwise the production process is in danger to be interrupted.

For these purposes, the Fieldbus Foundation specified the following Analog Input Block process alarms:

High Limit (HI_LIM, HI_PRI → HIGH_ALM),

High High Limit (HIGH_HIGH_LIM, HIGH_HIGH_PRI → HIGH_HIGH_ALM),

Low Limit (LOW_LIM, LOW_PRI → LOW_ALM), and

Low Low Limit (LOW_LOW_LIM, LOW_PRI → LOW_LOW_ALM).

Each of these alarms can be configured by the user, by setting the corresponding limit values (xxx_LIM, relative to OUT). In accordance to the following table of alarm priorities (xxx_PRI), the process alarms will be set and reported to the control system:

xxx_PRI	Description
0	Alarm is never reported and don't have to be acknowledged by user.
1	Alarm has been evaluated, but don't have to be acknowledged by user.
2-7	Alarm has been evaluated and reported according to the given priority (2 = low and 7 = high). The status of OUT changes to Good(NC):UnackAdvisoryAlarm:HighLimited.
8-15	Alarm has been evaluated and reported according to the given priority (2 = low and 7 = high). The status of OUT changes to Good(NC):UnackCiticalAlarm:HighLimited.

The current status of these alarms can be observed by referencing the associated process alarm parameters HI_ALM, HI_HI_ALM, LOW_ALM, or LOW_LOW_ALM.

To avoid alarm flicker if the OUT value oscillates around one of these alarm limits, the user is able to configure a hysteresis in parameter ALARM_HYS, as value in percent of the OUT_SCALE span.

5.4 Integrator Blocks Configuration

The two Integrator Blocks of the IFC090-FF are working very similar. The reason to support two Integrator Blocks is, that the IFC090-FF is capable of measuring forward (positive) and reverse (negative) flow at the same time. Both Integrators were intended to totalize the forward flow (Integrator 1 (Flow(+)-Totalizer) on the one hand, and the reverse flow (Integrator 2 (Flow(-)Totalizer) on the other.
The configuration of these blocks is almost the same, unless stated differently.

5.4.1 Integrator Block Mode Handling

By selecting the operation mode in parameter MODE_BLK, the operator is able to control the activities of the Integrator block. The following lists the available modes and meanings:

Integrator Block MODE_BLK	Description
Automatic (AUTO)	The Analog Input block performs its functional computations in accordance to its configuration automatically. Measurement deliverance is active.
Manual (Man)	The block doesn't perform an automatic deliverance of valid measurement values, but freezes the measurement processing to the last value obtained in Automatic mode. The OUT status limit switches to 'Constant'. In this mode it is possible to write to the OUT value an arbitrary value to test blocks that use this OUT value as input.
Out of Service (OOS)	The block stops its operation and freezes its measurement value to the last one obtained in Automatic mode. The OUT status switches to BAD:OutOfService:NotLimited.

5.4.2 Integration Input – Rate or Accumulated Pulses

Each Integrator consists of two input parameter IN_1 and IN_2, which can be used at the same time (e.g. for the totalization of two different flow meters). Both IN_1 and IN_2 can be configured as rate input (e.g. m3/s, kg/min, etc.) or as continuous accumulation of pulses.
By default both inputs are configured as rate, but can be configured separately as continuous accumulation of pulses by setting the options 'Input 1 accumulate' (for IN_1), or 'Input 2 accumulate' (for IN_2), respectively in parameter INTEG_OPTS to true.

5.4.3 Adaptation of Integrator Inputs

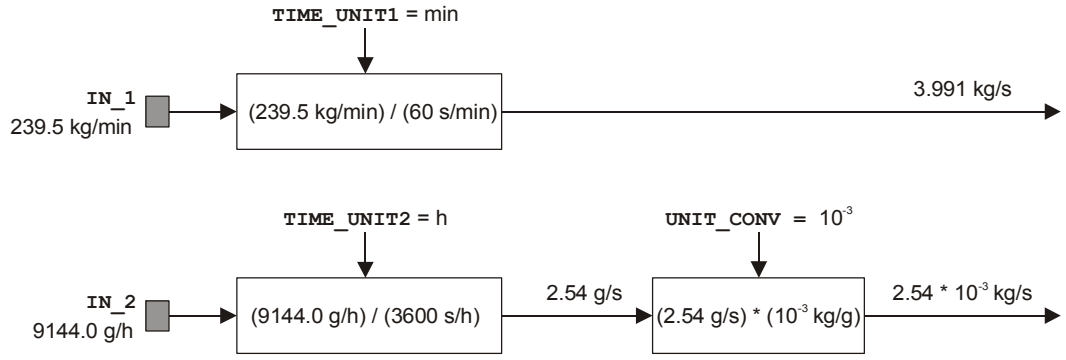
The integration process is a function that maps a quantity unit per time unit (in case of a rate input), or a number of pulses (in case of continuous accumulation) to a total quantity unit. For this reason, it is necessary to adapt the inputs to the needs of the integration process. For the two possible integration types, different adaptations are required:

Rate input

The input is a quantity unit per time unit (e.g. IN_1 is given as kg/h: quantity unit is kg, time unit is h). Since the integration process operates with a time unit of seconds (s), the inputs IN_1 and IN_2 has to be adapted to this unit. This has to be done by setting the parameters TIME_UNIT1 (for IN_1) and TIME_UNIT2 (for IN_2) to the time unit used by the input (for the example above, TIME_UNIT1 has to be set to 'hours' (h)).

Since the integration process adds the inputs IN_1 and IN_2 (if both are used), it is necessary to convert one input into the unit of the other input. This is done by specifying a conversion factor to convert the quantity unit of IN_2 to the quantity unit of IN_15. This conversion factor can be specified by setting the parameter UNIT_CONV to the appropriate value.

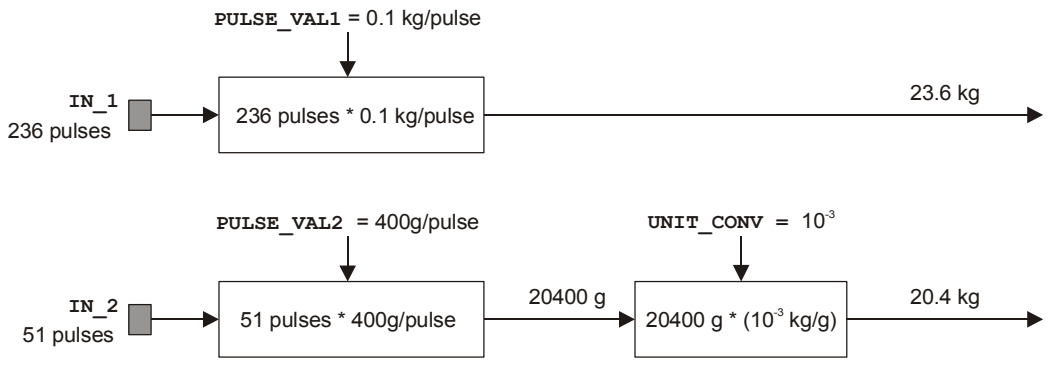
Example:



Accumulation input

The inputs of IN_1 and IN_2 are numbers of pulses. Since the integration process operates with a quantity unit, it has to be specified for each input how many quantities of these unit represent one pulse. This has to be done by setting the parameters PULSE_VAL1 (for IN_1) and PULSE_VAL2 (for IN_2) to the amount of quantity per pulse.

Since the integration process adds the inputs IN_1 and IN_2 (if both are used), it is necessary to convert one input into the unit of the other input. As at Rate input, this is done by specifying the conversion factor UNIT_CONV, that defines a unit conversion from IN_2 into IN_1.



[5] Since both inputs already have the same time base (if *TIME_UNIT1* and *TIME_UNIT2* are correct configured), it isn't necessary to covert the time base, too.

Example:

5.4.4 Setting the Flow Direction

The IFC090-FF integrators are capable of integrating three different kinds of flows:

- Forward (positive) Flow
- Reverse (negative) Flow
- Net Flow (positive- and negative flow)

By default, Integrator 1 is configured to integrate over Forward Flow and Integrator 2 over Reverse Flow.
This configuration can be changed by modifying the parameter INTEG_OPTS in the following way:

- Flow Forward (default for Integrator 1)
  Enable option 'Flow forward' in parameter INTEG_OPTS (i.e. set to true), and ensure that option 'Flow reverse' is disabled (i.e. set to false).
- Flow Reverse (default for Integrator 2)
  Enable option 'Flow reverse' in parameter INTEG_OPTS (i.e. set to true), and ensure that option 'Flow forward' is set disabled (i.e. set to false).
- Net Flow
  Ensure that both options 'Flow forward' and 'Flow reverse' are disabled (set to false).

5.4.5 Type of Integration

The IFC090-FF integrators support the following seven Fieldbus Foundation specified integrator types, which can be selected in parameter INTEG_TYPE:

Integrator Types	Description
Up auto	Totalization starts with 0.0 and counts up with automatic reset if the setpoint TOTAL_SP is reached.
Up demand	Totalization starts with 0.0 and counts up. A reset isn't performed except either a reset is initiated by a write to RESET_IN or OP_CMD_INT.
Down auto	Totalization starts with the setpoint TOTAL_SP and counts down with automatic reset if 0.0 is reached.
Down demand	Totalization starts with the setpoint TOTAL_SP and counts down. A reset isn't performed except a rest is initiated by a write to RESET_IN or OP_CMD_INT.
Periodic	Totalization starts with 0.0 and counts up. An automatic reset is performed in accordance to the time given in parameter CLOCK_PER. **NOTE**: RESET_IN and OP_CMD_INT resets are disabled and would produce a 'Wrong Mode for Request Error'.
Demand	Totalization starts with 0.0 and counts up. To perform a reset, the operator has to write 'reset' to parameter OP_CMD_INT.
Periodic & Demand	Same as 'Periodic' with the exception that RESET_IN and OP_CMD_INT resets are possible.

The a.m. setpoint TOTAL_SP can be set by user to an arbitrary value and is writable in every Integrator Block operation mode. It defines the reset or starting points for the Up- and Down-integration types.
RESET_IN and OP_CMD_INT can be used to initiate an operator controlled reset. While RESET_IN is an input parameter, which can be linked to any discrete output parameter of another block, OP_CMT_INT is a contained parameter, which only can be changed by a direct write.
For the Periodic integration type, it is necessary to define a time, the totalization is being reset. CLOCK_PER is the parameter referenced for this time and interpreted as value with unit seconds. The user can set this parameter to any arbitrary value.

5.4.6 Integrator Reset Strategies

Depending on the chosen type of Integration (see 5.4.5), the integrators support different kinds of reseting the totalization (i.e. the value of output parameter OUT). In the following, possible reset strategies are described subject to the integration type:

Up auto

There are two kinds of reset possible:

- Automatic Reset
  Reference point is the value of TOTAL_SP. If the totalization, i.e. the OUT value, exceeds TOTAL_SP, it is reset to zero (0.0). A snapshot of the value at which the reset happened is saved in parameter STOTAL6.
- Operator Reset
  No integrator internal reference point is used, but an input signal coming from another block or the operator. By writing ‘reset’ to parameter OP_CMT_INT, the operator is able to reset the totalization at any point in time.
  If the operator wants to define a control strategy for resetting the totalization, it can use the input parameter RESET_IN. Connecting this parameter with a different block’s discrete output parameter makes is possible to reset the totalization by sending a value not equal to zero (0) via this connection.

Up demand

Only one kind of reset is possible: Operator Reset. See ‘Up auto‘ above for details.

Down auto

Similar two Up auto, two kinds of reset are possible:

- Automatic Reset
  Reference point is 0.0. If the totalization, i.e. the OUT value, falls below 0.0, it is reset to TOTAL_SP. A snapshot of the value at which the reset happened is saved in parameter STOTAL7.
- Operator Reset
  See ‘Up auto’, ‘Operator Reset’ for details.

[6] This could be useful, since normally the totalization isn’t reset exactly with the value of TOTAL_SP, but with a value with an additional amount of measurement quantity.
[7] This could be useful, since normally the totalization isn’t reset exactly with the value of TOTAL_SP, but with a value with an additional amount of measurement quantity.

Down demand

Only one kind of reset is possible: Operator Reset. See ‘Down auto‘ above for details.

Periodic

In difference to the integration types so far, this type does not support resets depending on totalization values and/or operator signals. The periodic integration type also performs a automatic reset, but this reset is caused by a elapsed time duration. If since the last reset the time specified in CLOCK_PER is elapsed, the totalization is reset to zero (0.0).

An operator based reset is not possible; in contrast a write to OP_CMD_INT or RESET_IN would cause a ‘Wrong Mode for Request’ error.

Demand

Automatic resets are not performed with this setting, only operator controlled resets are possible. A write to OP_CMD_INT or RESET_IN, respectively are the only possibilities to cause a totalization reset.

Periodic & Demand

This combines the reset possibilities of settings ‘Periodic’ and ‘Demand’, i.e. time based and operator resets are possible.

Normally, the reset residual (i.e. the absolute difference between the reset point and the current value just before the reset) isn’t considered in any way. But in some application it may be important, to carry this residual to the next integration cycle. Enable option ‘Carry’ (i.e. set true) in parameter INTEG_OPTS. In order to configure how to carry over the residual,

Common to all resets is the handling of the following parameters:

STOTAL

Snapshot of the totalization value just before the last reset.

SRTOTAL

Snapshot of the RTOTAL, i.e. input values with BAD status, just before the last reset.

SSP

Snapshot of the Set Point, i.e. setting of TOTAL_SP, just before the last reset. Useful, if TOTAL_SP was changed since the last reset.

N_RESET

Number of resets. Useful to verify if a reset happened since the last reset.

RESET_CONFIRM

Used by control systems to confirm a reset, if confirmation is configured.

To configure reset confirmation, enable option ‘Confirm reset’ (i.e. set to true) in parameter INTEG_OPTS.

If the control system should be notified about a reset events, this must be enabled by setting the option 'Generate reset event' in parameter INTEG_OPTS.

5.4.7 Trip and Pre-trip Handling

TOTAL_SP marks not only the value for automatic resets as described in the former section, it also serves as trip value for batch totalizations.

Batch totalizations are possible for integration types (see 5.4.5) 'Up auto', 'Up demand', 'Down auto', and 'Down demand' and works as follows:

UP auto and UP demand

If OUT	≥	PRE_TRIP	⇒	OUT_PTRIP is set (i.e. set to 255)
If OUT	≥	TOTAL_SP	⇒	OUT_TRIP is set (i.e. set to 1)

Down auto and Down demand

If OUT	≤	PRE_TRIP	⇒	OUT_PTRIP is set (i.e. set to 255)
If OUT	≤	0	⇒	OUT_TRIP is set (i.e. set to 1)

If a reset occurs, the conditions that set OUT_PTRIP and OUT_TRIP are no longer true, so they are cleared. In any case, OUT_TRIP is set for at least 5 seconds, even if a reset happened. From this, the control system should be able to read the set OUT_TRIP for at least one time.

5.4.8 Status Handling

The status of the output totalization value OUT depends on the statuses of all integrated input values of IN_1 and IN_2.

All inputs are grouped in inputs with Good status, and inputs with Bad status (whereas an input with Uncertain status is deemed to be Bad). The dynamic parameter PCT_INCL always reflects the percentage ratio of inputs with Bad status.

What status the output has depends on this Bad ratio. The resulting output status can be configured by setting the parameters GOOD_LIM and UNCERT_LIM. The relations between these parameters, the ratio PCT_INCL, and the resulting output status are as follows:

If	100%	≤	PCT_INCL	<	GOOD_LIM	⇒	Output status = Good
If	GOOD_LIM	≤	PCT_INCL	<	UNCERT_LIM	⇒	Output status = Uncertain
If	UNCERT_LIM	≤	PCT_INCL	≤	0	⇒	Output status = Bad

5.4.9 Input Value Handling

Normally, the inputs of IN_1 and IN_2 are used as they are:

- input status = *Good* ⇒ value is used for the integration.
- input status = *Uncertain* ⇒ value of last input with *Good* status is used instead
- input status = *Bad* ⇒ value of last input with *Good* status is used instead

This strategy can be enabling by one or more of the following INTEG_OPTS options:

INTEG_OPTS	Description if enabled (i.e set to true)
Use Uncertain	Input values of *IN_1* or *IN_2* are also used for the integration, if their status are *Uncertain*. The calculation of *RTOTAL* isn't affected by this setting (i.e. the value is used for the integration, but even though the input is interpreted as *Bad* and added to *RTOTAL*).
Use Bad	Status of input values of *IN_1* or *IN_2* isn't interpreted as *Bad* value in the calculation of *RTOTAL* even if they're really *Bad*. **NOTE:** This doesn't mean, that the values of inputs with *Bad* status are used for the integration! The last value with *Good* status is used further on!
Add zero if Bad	Instead of using the last value with *Good* status for integration, zero (0.0) is used, if the status of the input of *IN_1* or *IN_2* is Bad.

6 Troubleshooting

This chapter documents the possible errors that can occur. They are ordered by error parameter or block. Normally, the errors don't occur solely, but in conjunction with other errors, described here.

6.1 BLOCK_ERROR

Each block has a parameter BLOCK_ERR, that reflects possible problems with the block. The following describes these possible problems and the necessary action to be taken by the user.

6.1.1 Resource Block

The following table lists the block errors documented by the Resource Block:

Error Code	Description	Action
Out of Service	Target mode is set to *'Out of Service (OOS)'*	If Automatic is the desires target mode, set *MODE_BLK* target to *'Automatic (Auto)'*
Power-up	Power failure of measurement electronics (**NOTE:** Not the bus power!)	This requires an action at the device's display: Quit the 'ERROR QUIT' menu at the device's display. Refer to the 'Installation and operating instructions, Signal converters for electromagnetic flowmeters' manual. Note: No counting during power failure.
Device needs Maintenance	Fatal error of the measurement electronics	Replace signal converter or contact KROHNE service.
Memory Failure	Device memory failure	Replace signal converter or contact KROHNE service.
Input Failure	AD converter error.	Replace signal converter or contact KROHNE service.
Other	Other hardware problem.	Replace signal converter or contact KROHNE service.

6.1.2 Transducer Block

The following table lists the block errors documented by the Transducer Block:

Error Code	Description	Action
Out of Service	Target mode is set to *'Out of Service (OOS)'*	If Automatic is the desired target mode, set *MODE_BLK* target to *'Automatic (Auto)'*
	Communication problem between FF module and measurement module	Replace signal converter or contact KROHNE service.
Device Needs Maintenance Now	AD converter error.	Replace signal converter or contact KROHNE service.

6.1.3 Analog Input Block

The follwowing table lists the block errors documented by the Analog Input Block:

Error Code	Description	Action
Out of Service	Target mode is set to *'Out of Service (OOS)'*	If Automatic is the desired target mode, set *MODE_BLK* target to *'Automatic (Auto)'*.
	'Block Configuration Error' is also set	See *'Block Configuration Error'* description below.
Block Configuration Error	Value of *CHANNEL* ≠ 1	Set the value of CHANNEL to 1.
	Value of *L_TYPE* is unspecified.	Set value of *L_TYPE* to *'Direct'*, *'Indirect'*, or *'Indirect Square Root'*. **NOTE:** If set to 'Indirect' or 'Indirect Square Root', don't forget to configure parameter *OUT_SCALE*!
	Unit of *XD_SCALE* is not equal to unit of Transducer Block parameter *PRIMARY_VALUE_RANGE*	Set the unit of *XD_SCALE* to the same unit as *PRIMARY_VALUE_RANGE*. **NOTE:** Since the unit of *PRIMARY_VALUE_RANGE* is fixed to m^3/s, this always must be m^3/s.

Some IFC090 measurement problems can be read from the Analog Input Block parameter OUT status. The following table lists (almost) all of the Analog Input OUT statuses that are mapped to IFC090 (Precondition: Analog Input Block is configured and target mode is set to Automatic, see 5.3):

OUT status	Description	Action
Good:NonSpecific:NotLimited	No IFC090 problem detected	n/a
Bad:NonSpecific.NotLimited	Old measurement value. The value has not been updated for a long period of time.	Normally, this status will disappear after a short period. If not, replace signal converter or contact KROHNE service.
Bad:ConfigurationError:NotLimited	Analog Input Block configuration is incorrect.	Check parameters CHANNEL, L_TYPE and XD_SCALE. Configure them as described in 5.3.
Bad:DeviceFailure:NotLimited		
Bad:DeviceFailure:Constant	AD converter error.	Replace signal converter or contact KROHNE service.
Bad:SensorFailure:Constant	Measured value is outside of sensor range.	Check instrument parameters and correct it if necessary. Error messages deleted automatically.
Bad:OutOfService:NotLimited	Actual mode is Out of Service.	Check the target mode and ensure that it is set to 'Auto' mode.
Uncertain:NonSpecific:NotLimited	Pipe is empty	Fill the pipe with media.
	AD converter overshooted.	Check instrument parameters and correct it if necessary. Error messages deleted automatically.

Other possibly occuring statuses correspond to the PRIMARY_VALUE statuses. See 6.1.3 for details.

6.1.4 Integrator Blocks

The follwowing table lists the block errors documented by the Integrator Blocks:

Error Code	Description	Action
Out of Service	Target mode is set to *'Out of Service (OOS)'*	If Automatic is the desired target mode, set *MODE_BLK* target to *'Automatic (Auto)'*
Memory Failure	Device memory failure.	Replace signal converter or contact KROHNE service.

6.2 Transducer Block XD_ERROR

The Transducer Block has a special error parameter XD_ERROR. If this error displays the error 'Electronics failure', the AD converter of the sensor seems to have problems. Please contact the KROHNE support team, if this error remains.

6.3 Measurement Value Status

Besides the problems that are displayed in the BLOCK_ERR parameter of each block, the status of the Transducer Block parameter PRIMARY_VALUE (the raw measurement value obtained from the device) can provide further information on possible reasons for measurement problems.

The following table lists possible indications:

PRIMARY_VALUE state	Description	Action
BAD:OutOfService:Not Limited	Target mode is set to *'Out of Service (OOS)'*	If *Automatic* is the desired target mode, set *MODE_BLK* target to *'Automatic (Auto)'*
BAD:DeviceFailure:Not Limited	AD converter fatal error.	Contact the KROHNE support team.
BAD:SensorFailure:Low Limited	Measured value is below the sensor range.	Check instrument parameters and correct it if necessary. Error messages deleted automatically.
BAD:SensorFailure:HighLimited	Measured value is above the sensor range.	Check instrument parameters and correct it if necessary. Error messages deleted automatically.
Uncertain:NonSpecific: NotLimited	Pipe is empty.	Fill the pipe with media.
	AD converter warning.	Check instrument parameters and correct it if necessary. Error messages deleted automatically.
Uncertain:NonSpecific: Constant	Current mode is *'Manual (Man)'*	If *Automatic* is the desired mode, set *MODE_BLK* traget to '*Automatic* (Auto)'.
Uncertain:SensorConversionNotAccurate:NotLimited	AD converter overshooted.	Check instrument parameters and correct it if necessary. Error messages deleted automatically.