



## **KH 8384-3 EN**

### **Translation of original instructions**



**Types 3730-3, 3730-6 and 3731-3 (Ex d) as well as TROVIS 3730-3  
and TROVIS 3793 Electropneumatic Positioners**

HART® communication



The mounting and operating instructions for the devices are included in the scope of delivery. The latest documentation is available on our website at [www.samson.de](http://www.samson.de) > **Service & Support** > **Downloads** > **Documentation**.

## Definition of signal words

### **DANGER**

*Hazardous situations which, if not avoided, will result in death or serious injury*

### **WARNING**

*Hazardous situations which, if not avoided, could result in death or serious injury*

### **NOTICE**

*Property damage message or malfunction*

### **Note**

*Additional information*

### **Tip**

*Recommended action*

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## 1 General

This Manual (KH 8384-3) supplements the standard instructions of the positioners and the associated diagnostics instructions:

**Table 1:** *Associated documentation*

Positioner	Standard instructions	Diagnostics instructions
TROVIS 3730-3	▶ EB 8484-3	▶ EB 8389-3
TROVIS 3793	▶ EB 8493	▶ EB 8389-2
TROVIS SAFE 3793	▶ EB 8493S	▶ EB 8389-2S
Type 3730-3	▶ EB 8384-3	▶ EB 8389
Type 3730-6	▶ EB 8384-6	▶ EB 8389-1
TROVIS SAFE 3730-6	▶ EB 8384-6S	▶ EB 8389-1S
Type 3731-3	▶ EB 8387-3	▶ EB 8389
TROVIS SAFE 3731-3	▶ EB 8387-3S	▶ EB 8389S

These instructions describe the most important HART® commands used together with the above listed SAMSON positioners.

### 1.1 HART® revisions

#### **TROVIS 3730-3, TROVIS 3793 and TROVIS SAFE 3793**

These positioners are delivered with HART® revision 7. It is not possible to change them to a different HART® revision.

#### **Type 3730-3, Type 3731-3 and TROVIS SAFE 3731-3**

These positioners are delivered with HART® revision 5. Switchover to HART® revision 6 is possible in the 'HART revision' parameter (over DTM, EDD or TROVIS-VIEW).

#### **Type 3730-6 and TROVIS SAFE 3730-6**

These positioners are delivered with HART® revision 5. It is not possible to change them to a different HART® revision.

## 2 Device status and response codes

The device response consists of 2 bytes. The first byte represents either the communication status or the response code. If the most significant bit (0x80) of the first byte is set, this byte represents the communication status listed in Table 2. If the bit is not set, the first byte represents the response code according to Table 3.

The second byte always contains the device status.

### 2.1 Communication status

A communication status is indicated by the response code whenever a communication error occurs.

**Table 2:** *Communication status*

Bit	Definition
0x80	This bit must be set to 1 to indicate a communication error.
0x40	<i>Vertical Parity Error</i> – The parity of one or more of the bytes received by the device was not uneven.
0x20	<i>Overrun Error</i> – At least one byte of data in the receive buffer of the UART was overwritten before it was read (i.e. the slave did not process the incoming byte fast enough).
0x10	<i>Framing Error</i> – The stop bit of one or more bytes received by the device was not detected by the UART (i.e. a marking or 1 was not detected if a stop bit should have occurred).
0x08	<i>Longitudinal Parity Error</i> – The Longitudinal Parity calculated by the device did not match the Longitudinal Parity byte at the end of the message.
0x04	Reserved – set to zero
0x02	<i>Buffer Overflow</i> – The message was too long for the receive buffer of the device.
0x01	Reserved – set to zero

If a communication error has not occurred, the response code contains a zero in the most significant bit and the code represents the following described code (0 to 127). The response code is transferred in the first byte of the data field and indicates the status of the command. A zero value indicates that the command is OK. A value unequal to zero means that there is an error (see “Response codes” on page 6).

### 2.2 Response codes

**Table 3:** *Response codes*

Value	Definition
0	Successful
2	Invalid selection
3	Passed parameter too large
4	Passed parameter too small
5	Too few data bytes received
6	Device-specific command error
7	In write protection mode
9	Invalid date code detected
10	Lower range value too low
11	Upper range value too high
12	Upper range value too low
16	Access restricted
18	Invalid device code
17	Invalid device variable index
20	Invalid extended command number
29	Invalid span
32	Busy

## 2.3 Device status

This byte indicates the current status of the field device.

**Table 4:** *Device status*

Bit	Definition
0x80	A serious device error has occurred. This error endangers the functioning of the device.
0x40	<i>Configuration Changed</i> – The device configuration has been changed. It may have been changed by HART®, TROVIS-VIEW or through local operation.
0x20	<i>Cold Start</i> – The device has been restarted.
0x10	<i>More Status Available</i> – Further status information is available in <b>Code 48</b> ( <i>Read Additional Status Information</i> )
0x08	<i>Loop Current Fixed</i> – The loop current is kept at a fixed value and does not respond anymore to the process variables.
0x04	<i>Loop Current Saturated</i> – The loop current has reached its upper (or lower) limit and cannot rise (or fall) any further.
0x02	<i>Non-Primary Variable Out of Limits</i> – A device variable, other than that of the Primary Variable, is beyond the operating limits of the device.
0x01	<i>Primary Variable Out of Limits</i> – The Primary Variable PV is beyond the operating limits of the device.

### 3 Universal commands

#### 3.1 Command 0 (Read Unique Identifier)

Table 5: Command 0

Byte	Definition	Type 3730-3	Type 3730-6	Type 3731-3	TROVIS 3730-3	TROVIS 3793	TROVIS SAFE 3730-6	TROVIS SAFE 3731-3	TROVIS SAFE 3793
0	254	•	•	•	•	•	•	•	•
1	Manufacturer identification code (66 stands for SAMSON)	•	•	•	•	•	•	•	•
2	Device type	•	•	•	•	•	•	•	•
3	Minimum number of preambles (master to slave)	•	•	•	•	•	•	•	•
4	HART® revision number	•	•	•	•	•	•	•	•
5	Device revision number	•	•	•	•	•	•	•	•
6	Software version number	•	•	•	•	•	•	•	•
7	Hardware version number	•	•	•	•	•	•	•	•
8	Flags	•	•	•	•	•	•	•	•
9 to 11	Serial number of the device	•	•	•	•	•	•	•	•
12	Minimum number of preambles (slave to master)	•	•	•	•	•	•	•	•
13	Maximum number of device variables	•	•	•	•	•	•	•	•
14 and 15	Counter for configuration change	•	•	•	•	•	•	•	•
16	Additional field device status (maintenance indicator)	-	-	-	•	•	-	-	•
17 and 18	Manufacturer identification code and device type	-	-	-	•	•	-	-	•
19 and 20	Code for sales partner's own brand	-	-	-	•	•	-	-	•
21	Device profile	-	-	-	•	•	-	-	•



### 3.2 Command 1 (*Read Primary Variable*)

Command 1 indicates the percent of the Primary Variable. The Primary Variable corresponds to the reference variable in the default setting.

**Table 6:** *Command 1*

Byte	Definition	Type 3730-3	Type 3730-6	Type 3731-3	TROVIS 3730-3	TROVIS 3793	TROVIS SAFE 3730-6	TROVIS SAFE 3731-3	TROVIS SAFE 3793
0	Unit of the Primary Variable	•	•	•	•	•	•	•	•
1 to 4	Value of the Primary Variable	•	•	•	• <sup>1)</sup>	• <sup>1)</sup>	•	•	• <sup>1)</sup>

<sup>1)</sup> IEEE standard: 4-byte float

### 3.3 Command 3 (*Read Dynamic Variables and Loop Current*)

Command 3 reads the values of the four Dynamic Variables.

The assignment between the four Dynamic Variables and the selection from the twelve device variables is made by command 51. Table 7 lists the currently available device variables.

#### **Types 3730-3 and 3731-3 as well as TROVIS SAFE 3731-3**

The reference variable is fixed as the first Dynamic Variable and cannot be changed,

#### **Type 3730-6 and TROVIS SAFE 3730-6**

The first Dynamic Variable can be selected as required.

- Value 0: manipulated variable
- Value 1: set point
- Value 2: target position
- Value 3: valve position
- Value 4: set point deviation e
- Value 5: absolute total valve travel
- Value 6: binary input state
- Value 7: status of the internal solenoid valve/forced venting
- Value 8: NAMUR condensed state
- Value 9: current temperature

## Universal commands

- Value 10: leakage sensor sound level
- Value 11: differential pressure

### TROVIS 3730-3

The first Dynamic Variable can be selected as required.

- Value 0: manipulated variable
- Value 1: valve position
- Value 2: set point deviation
- Value 3: NAMUR condensed state
- Value 4: switching state of binary input (option A)
- Value 5: switching state of binary input (option B)
- Value 6: total valve travel
- Value 7: current temperature
- Value 8: status of the last partial stroke test (PST)
- Value 9: status of the last full stroke test (FST)
- Value 10: discrete final valve position

### TROVIS 3793 and TROVIS SAFE 3793

The first Dynamic Variable can be selected as required.

- Value 0: manipulated variable
- Value 1: valve position
- Value 2: set point deviation
- Value 3: NAMUR condensed state
- Value 4: switching state of binary input (option module A1)
- Value 5: switching state of binary input (option module B1)
- Value 6: switching state of binary input (option module A2)
- Value 7: switching state of binary input (option module B2)
- Value 8: switching state of binary input (option module A3)
- Value 9: switching state of binary input (option module B3)
- Value 10: total valve travel
- Value 11: current temperature
- Value 12: status of the last partial stroke test (PST)
- Value 13: status of the last full stroke test (FST)
- Value 14: discrete final valve position
- Value 15: supply pressure
- Value 16: relative pressure Y1 (pressure sensors)
- Value 17: relative pressure Y2 (pressure sensors)

**Table 7: Command 3**

Byte	Definition	Type 3730-3	Type 3730-6	Type 3731-3	TROVIS 3730-3	TROVIS 3793	TROVIS SAFE 3730-6	TROVIS SAFE 3731-3	TROVIS SAFE 3793
Byte 0 to 3	Reference variable in mA	•	•	•	-	-	•	•	-
	Value of the loop current	-	-	-	•	•	-	-	•
Byte 4	Unit of the Primary Variable	•	•	•	•	•	•	•	•
Byte 5 to 8	Value of the Primary Variable	•	•	•	•	•	•	•	•
Byte 9	Unit of the Secondary Variable	•	•	•	•	•	•	•	•
Byte 10 to 13	Value of the Secondary Variable	•	•	•	•	•	•	•	•
Byte 14	Unit of the Tertiary Variable	•	•	•	•	•	•	•	•
Byte 15 to 18	Value of the Tertiary Variable	•	•	•	•	•	•	•	•
Byte 19	Unit of the Quaternary Variable	•	•	•	•	•	•	•	•
Byte 20 to 23	Value of the Quaternary Variable	•	•	•	•	•	•	•	•

### 3.4 Command 33 (Read Device Variables)

Command 33 is used to read the value of up to four of the following device variables. The indices of the read variables are specified.

**Table 8: Command 33**

Byte	Definition	Type 3730-3	Type 3730-6	Type 3731-3	TROVIS 3730-3	TROVIS 3793	TROVIS SAFE 3730-6	TROVIS SAFE 3731-3	TROVIS SAFE 3793
Value 0	Positioning value	•	•	•	-	-	•	•	-
Value 1	Set point	•	•	•	-	-	•	•	-

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Byte	Definition	Type 3730-3	Type 3730-6	Type 3731-3	TROVIS 3730-3	TROVIS 3793	TROVIS SAFE 3730-6	TROVIS SAFE 3731-3	TROVIS SAFE 3793
Value 2	Target position	•	•	•	-	-	•	•	-
Value 3	Valve position	•	•	•	-	-	•	•	-
Value 4	Set point deviation e	•	•	•	-	-	•	•	-
Value 5	Absolute total valve travel	•	•	•	-	-	•	•	-
Value 6	Binary input state (optional)	•	•	•	-	-	•	•	-
Value 7	Status of the internal solenoid valve/forced venting (optional)	•	•	•	-	-	•	•	-
Value 8	NAMUR condensed state	•	•	•	-	-	•	•	-
Value 9	Current temperature	•	•	•	-	-	•	•	-
Value 10	Leakage sensor sound level (optional)	•	•	•	-	-	•	•	-
Value 11	Differential pressure (Type 3730-6)	•	•	•	-	-	•	•	-

### 3.5 Command 38 (*Reset Configuration Change Flag*)

Command 38 resets the configuration change flag. This flag is always reset when a value is written to the EEPROM.

### 3.6 Command 48 (Read Additional Status)

The command 48 reads the additional device status. The internal error bytes are returned which, for example, contain error messages for the closed-loop operation (control loop error etc.).

Byte	Definition	Type 3730-3	Type 3730-6	Type 3731-3	TROVIS 3730-3	TROVIS 3793	TROVIS SAFE 3730-6	TROVIS SAFE 3731-3	TROVIS SAFE 3793
Byte 0	Internal error bytes	● 1)	● 4)	● 1)	● 6)	● 8)	● 4)	● 1)	● 8)
Byte 1	Internal error bytes	● 1)	● 4)	● 1)	● 6)	● 8)	● 4)	● 1)	● 8)
Byte 2	Internal error bytes	● 1)	● 4)	● 1)	● 6)	● 8)	● 4)	● 1)	● 8)
Byte 3	Internal error bytes	● 1)	● 4)	● 1)	● 6)	● 8)	● 4)	● 1)	● 8)
Byte 4	Cold start flag	●	–	●	–	–	–	●	–
	Internal error bytes	–	● 4)	–	● 6)	● 8)	● 4)	–	● 8)
Byte 5	Initialization	● 2)	–	● 2)	–	–	–	● 2)	–
	Internal error bytes	–	● 4)	–	–	● 8)	● 4)	–	● 8)
Byte 6	Additional device status (0/1)	●	●	●	●	●	●	●	●
Byte 7	Device operating mode (= 0)	●	●	●	●	●	●	●	●
Byte 8	Analog channel saturated (= 0)	●	●	●	–	–	●	●	–
	Standardized status 0	–	–	–	●	●	–	–	●
Byte 9	Analog channel saturated (= 0)	●	●	●	–	–	●	●	–
	Standardized status 1	–	–	–	●	●	–	–	●
Byte 10	Analog channel saturated (= 0)	●	●	●	●	●	●	●	●
Byte 11	Analog channel fixed (= 0)	●	●	●	–	–	●	●	–
	Standardized status 2	–	–	–	●	●	–	–	●
Byte 12	Analog channel fixed (= 0)	●	●	●	–	–	●	●	–
	Standardized status 3	–	–	–	●	●	–	–	●
Byte 13	Analog channel fixed (= 0)	●	●	●	●	●	●	●	●

## Universal commands

Byte	Definition	Type 3730-3	Type 3730-6	Type 3731-3	TROVIS 3730-3	TROVIS 3793	TROVIS SAFE 3730-6	TROVIS SAFE 3731-3	TROVIS SAFE 3793
Byte 14	Device family status 0	•	•	•	–	–	•	•	–
	NAMUR status messages of the extended diagnostics	–	–	–	–	–	–	–	• 9)
Byte 15	Device family status 1	•	•	•	–	–	•	•	–
	NAMUR status messages of the extended diagnostics	–	–	–	–	–	–	–	• 9)
Byte 16	Device family status 2	•	•	•	–	–	•	•	–
	PST (0 = cancellation condition, 1 = start condition)	–	–	–	•	• 9)	–	–	• 9)
Byte 17	NAMUR status	• 3)	• 5)	• 3)	–	–	• 5)	• 3)	–
	FST (0 = cancellation condition, 1 = start condition)	–	–	–	•	• 9)	–	–	• 9)
Byte 18	NAMUR status messages of the extended diagnostics	• 3)	• 5)	• 3)	–	–	• 5)	• 3)	–
Byte 19	NAMUR status messages of the extended diagnostics	• 3)	• 5)	• 3)	–	–	• 5)	• 3)	–
Byte 20	NAMUR status messages of the extended diagnostics	• 3)	• 5)	• 3)	• 7)	• 9)	• 5)	• 3)	• 9)
Byte 21	NAMUR status messages of the extended diagnostics	• 3)	• 5)	• 3)	• 7)	• 9)	• 5)	• 3)	• 9)
Byte 22	NAMUR status messages of the extended diagnostics	• 3)	• 5)	• 3)	• 7)	• 9)	• 5)	• 3)	• 9)
Byte 23	NAMUR status messages of the extended diagnostics	• 3)	• 5)	• 3)	• 7)	• 9)	• 5)	• 3)	• 9)
Byte 24	NAMUR status messages of the extended diagnostics	• 3)	• 5)	• 3)	• 7)	• 9)	• 5)	• 3)	• 9)
Byte 25	NAMUR status messages of the extended diagnostics	• 3)	• 5)	• 3)	–	–	• 5)	• 3)	–
Byte 26	NAMUR status messages of the extended diagnostics	• 3)	• 5)	• 3)	–	–	• 5)	• 3)	–
Byte 27	NAMUR status messages of the extended diagnostics	• 3)	• 5)	• 3)	–	–	• 5)	• 3)	–
Byte 28	NAMUR status messages of the extended diagnostics	• 3)	• 5)	• 3)	–	–	• 5)	• 3)	–
Byte 29	NAMUR status messages of the extended diagnostics	• 3)	• 5)	• 3)	–	–	• 5)	• 3)	–
Byte 30	PST: results of current test	–	•	–	–	–	•	–	–
Byte 31	PST: results of current test	–	•	–	–	–	•	–	–
Byte 32	FST: results of current test	–	•	–	–	–	•	–	–
Byte 33	FST: results of current test	–	•	–	–	–	•	–	–
Byte 34	On/off (0 = no error/1 = error)	–	•	–	–	–	•	–	–
Byte 35	Temperature monitoring	–	•	–	–	–	•	–	–

1) Types 3730-3 and 3731-3 as well as TROVIS SAFE 3731-3

Byte	Bit	Error description	Menu item on display
0	0	x > range	50
	1	Delta x < range	51
	2	Attachment (mechanics/pneumatics)	52
	3	Initialization time exceeded	53
	4	Initialization/internal solenoid valve/forced venting	54
0	5	Transit time not reached	55
	6	Pin position missing	56
	7	Control loop error	57
1	0	Zero point	58
	1	Auto-correction	59
	2	Fatal error	60
	3	–	–
	4	x signal	62
	5	w too low	63
	6	i/p converter	64
	7	Hardware	65
2	0	Data memory	66
	1	Check calculation	67
	2	Control parameters	68
	3	Potentiometer parameters	69
	4	Calibration parameters	70
	5	General parameters	71
	6	–	–
	7	Internal device error	73
3	0	HART® parameters	74
	1	Info parameters	75
	2	No emergency mode	76
	3	Software loading error	77
	4	Option parameters	78
	5	–	–
	6	Diagnostic parameters	80
	7	–	–

## Universal commands

- 2) Types 3730-3 and 3731-3 as well as TROVIS SAFE 3731-3:

Byte	Bit	Message description
5	Bit 0	Positioner initialized (0/1)
	Bit 1	Positioner initialized in SUB mode (0/1)

- 3) Types 3730-3 and 3731-3 as well as TROVIS SAFE 3731-3:

Byte	Bit	Message description
17	Bit 0	No message
	Bit 1	Maintenance required
	Bit 2	Maintenance demanded
	Bit 3	Maintenance alarm
	Bit 7	Function check
18	Bit 0	Supply pressure – OK
	Bit 1	Supply pressure – Perhaps modified (TEST)
	Bit 2	Supply pressure – Perhaps not enough (TEST)
	Bit 3	Supply pressure – Perhaps not enough
	Bit 4	Supply pressure – Working at full capacity
	Bit 5	Supply pressure – Working at full capacity (TEST)
	Bit 6	Supply pressure – Perhaps modified
19	Bit 0	Actuator springs – OK
	Bit 1	Actuator springs – Spring stiffness may be reduced (spring failure) (TEST)
	Bit 2	Actuator springs – Perhaps bias reduced (TEST)
	Bit 3	Actuator springs – Perhaps bias increased (TEST)
	Bit 4	Working at full capacity
	Bit 5	Working at full capacity (TEST)
20	Bit 0	Shifting working range – OK
	Bit 1	Shifting working range – Shifting working range to closing position
	Bit 2	Shifting working range – Shifting working range to max. opening
21	Bit 0	Friction – OK
	Bit 1	Friction – Much higher over whole range
	Bit 2	Friction – Much lower over whole range
	Bit 3	Friction – Much higher over section
	Bit 4	Friction – Much lower over section
	Bit 5	Friction – Much higher over whole range (TEST)
	Bit 6	Friction – Much lower over whole range (TEST)
	Bit 7	Friction – Much higher over section (TEST)
	Bit 8	Friction – Much lower over section (TEST)



Byte	Bit	Message description
22	Bit 0	Leakage pneumatics – OK
	Bit 1	Leakage pneumatics – Perhaps existing (TEST)
	Bit 2	Leakage pneumatics – Perhaps existing
22	Bit 3	Leakage pneumatics – Perhaps too large (TEST)
	Bit 4	Leakage pneumatics – Perhaps too large
23	Bit 0	Limit working range – OK
	Bit 1	Limit working range – Down
	Bit 2	Limit working range – Up
	Bit 3	Limit working range – Modification impossible (jammed)
24		Dynamic stress factor [%]
25	Bit 0	Inner (seat) leakage – OK
	Bit 1	Seat leakage – May be higher than when new
	Bit 2	Seat leakage – May be higher than when new (TEST)
	Bit 3	Seat leakage – May exist
26	Bit 0	External leakage – OK
	Bit 1	External leakage – Perhaps soon expected
	Bit 2	External leakage – May exist
27	Bit 0	Observing end position – OK
	Bit 1	End position trending – Zero shifted monotonically decreasing, mean above reference graph
	Bit 2	End position trending – Zero shifted monotonically increasing, mean above reference graph
	Bit 3	End position trending – Zero alternates, mean above reference graph
	Bit 4	End position trending - Zero shifted monotonically decreasing, mean below reference graph
	Bit 5	End position trending - Zero shifted monotonically increasing, mean below reference graph
	Bit 6	End position trending – Zero alternates, mean below reference graph
28	Bit 0	Connection positioner - valve – OK
	Bit 1	Connection positioner - valve – No optimum travel transmission (TEST)
	Bit 2	Connection positioner - valve – Perhaps loose
	Bit 3	Connection positioner - valve – Perhaps range limit
	Bit 4	Connection positioner - valve – Perhaps loose (TEST)

## Universal commands

Byte	Bit	Message description
29	Bit 0	Working range – OK
	Bit 1	Working range – Mainly close to the CLOSED position
	Bit 2	Working range – Mainly close to the max. OPEN position
	Bit 3	Working range – Mainly in the CLOSED position
	Bit 4	Working range – Mainly in the max. OPEN position
30	Bit 0	Partial stroke test (PST) – OK
	Bit 1	Partial stroke test (PST) – Not OK
	<b>NOTE:</b> The exact source of errors must be read with CMD 161 (see section 3.7 on page 26).	

4) Type 3730-6 and TROVIS SAFE 3730-6:

Byte	Bit	Message description	Local operation
0	Bit 0	x > range	Code 50
	Bit 1	Delta x < range	Code 51
	Bit 2	Attachment	Code 52
	Bit 3	Initialization time exceeded	Code 53
	Bit 4	Internal solenoid valve/forced venting/supply pressure	Code 54
	Bit 5	Transit time not reached	Code 55
	Bit 6	Pin/switch position	Code 56
	Bit 7	Control loop	Code 57
1	Bit 0	Zero point	Code 58
	Bit 1	Inconsistent data memory	Code 59
	Bit 2	Internal device error	Code 60
	Bit 3	Kp too low	Code 61
	Bit 4	x signal	Code 62
	Bit 5	SIL deactivation/w too low	Code 63
	Bit 6	i/p converter	Code 64
	Bit 7	Hardware	Code 65
2	Bit 0	Check calculation	Code 67
	Bit 1	Pressure sensor	Code 72
	Bit 2	Emergency mode	Code 76
	Bit 3	Valve signature canceled	Code 81
	Bit 4	PST/FST status	Code 84
	Bit 5	On/off error activated	Code 85
	Bit 6	SIL test	Code 86

Byte	Bit	Message description	Local operation
3	Bit 0	Set point outside range	–
	Bit 1	Binary input error status	–
	Bit 2	Total valve travel exceeded	–
	Bit 3	Operating mode not AUTO	–
	Bit 4	Cold start	–
3	Bit 5	Positioner is not initialized	–
	Bit 6	Positioner was initialized in Sub mode	–
	Bit 7	–	–
The extended error messages are summarized in groups and transmitted as bits from this point onwards.			
4	Bit 0	Supply pressure	–
	Bit 1	Defective actuator springs	–
	Bit 2	Change in manipulated variable range	–
	Bit 3	Change in friction	–
	Bit 4	Pneumatic leakage	–
	Bit 5	Manipulated variable range limitation	–
	Bit 6	Seat leakage	–
	Bit 7	Packing leakage	–
5	Bit 0	Course of end position	–
	Bit 1	Positioner-valve linkage	–
	Bit 2	Manipulated variable range	–
	Bit 3	PST/FST	–
	Bit 4	Temperature monitoring	–

5) Type 3730-6 and TROVIS SAFE 3730-6:

Byte	Bit	Message description
17	Bit 0	No message
	Bit 1	Maintenance required
	Bit 2	Maintenance demanded
	Bit 3	Failure
	Bit 7	Function check

## Universal commands

Byte	Bit	Message description
18	Bit 0	Supply pressure – OK
	Bit 1	Supply pressure – Perhaps modified (TEST)
	Bit 2	Supply pressure – Perhaps not enough (TEST)
	Bit 3	Supply pressure – Perhaps not enough
	Bit 4	Supply pressure – Severe load
	Bit 5	Supply pressure – Severe load (TEST)
	Bit 6	Supply pressure – Perhaps modified
19	Bit 0	Actuator springs – OK
	Bit 1	Actuator springs – Spring stiffness may be reduced (spring failure) (TEST)
19	Bit 2	Actuator springs – Spring compression may be reduced (TEST)
	Bit 3	Actuator springs – Spring compression may be increased (TEST)
	Bit 4	Working at full capacity
	Bit 5	Severe load (TEST)
20	Bit 0	Shifting working range – OK
	Bit 1	Manipulated variable range trending – Operating range shifted to CLOSED position
	Bit 2	Manipulated variable range trending – Operating range shifted to max. OPEN position
21	Bit 0	Friction – OK
	Bit 1	Friction – Considerably higher across entire manipulated variable range
	Bit 2	Friction – Considerably lower across entire manipulated variable range
	Bit 3	Friction – Considerably higher across part of range
	Bit 4	Friction – Considerably lower across part of range
	Bit 5	Friction – Considerably higher across entire manipulated variable range (TEST)
	Bit 6	Friction – Considerably lower across entire manipulated variable range (TEST)
	Bit 7	Friction – Considerably higher across part of range (TEST)
	Bit 8	Friction – Considerably lower across part of range (TEST)
22	Bit 0	Leakage pneumatics – OK
	Bit 1	Leakage pneumatics – Perhaps existing (TEST)
	Bit 2	Leakage pneumatics – Perhaps existing
	Bit 3	Leakage pneumatics – Perhaps too large (TEST)
	Bit 4	Leakage pneumatics – Perhaps too large

Byte	Bit	Message description
23	Bit 0	Limit working range – OK
	Bit 1	Manipulated variable range limitation – At lower range value
	Bit 2	Manipulated variable range limitation – At upper range value
	Bit 3	Manipulated variable range limitation – No change possible (jammed)
24		Dynamic stress factor [%]
25	Bit 0	Inner (seat) leakage – OK
	Bit 1	Seat leakage – May be higher than when new
	Bit 2	Seat leakage – May be higher than when new (TEST)
	Bit 3	Seat leakage – may exist
26	Bit 0	External leakage – OK
	Bit 1	External leakage – Perhaps soon expected
	Bit 2	External leakage – May exist
27	Bit 0	Observing end position – OK
	Bit 1	End position trending – Zero shifted monotonically decreasing, mean above reference graph
	Bit 2	End position trending – Zero shifted monotonically increasing, mean above reference graph
	Bit 3	End position trending – Zero alternates, mean above reference graph
	Bit 4	End position trending - Zero shifted monotonically decreasing, mean below reference graph
	Bit 5	End position trending - Zero shifted monotonically increasing, mean below reference graph
	Bit 6	End position trending – Zero alternates, mean below reference graph
28	Bit 0	Connection positioner - valve – OK
	Bit 1	Connection positioner - valve – No optimal travel transmission (TEST)
	Bit 2	Connection positioner - valve – Perhaps loose
	Bit 3	Connection positioner - valve – Perhaps range limit
	Bit 4	Connection positioner - valve – Perhaps loose (TEST)
29	Bit 0	Working range – OK
	Bit 1	Manipulated variable range – Mainly near CLOSED position
	Bit 2	Manipulated variable range – Mainly near max. OPEN position
	Bit 3	Manipulated variable range – Mainly CLOSED position
	Bit 4	Manipulated variable range – Mainly max. OPEN position

## Universal commands

Byte		Message description
30/31	00000000 00000001	No PST performed
	00000000 00000010	PST completed successfully
	00000000 00000100	x cancellation
	00000000 00001000	$\Delta p_{out}$ cancellation
	00000000 00010000	Tolerance band exceeded
	00000000 00100000	Max. test duration exceeded
	00000000 01000000	Test canceled manually
	00000000 10000000	Measured data memory full
	00000001 00000000	Cancel internal solenoid valve/forced venting
	00000010 00000000	Canceled by control loop error
	00000100 00000000	Set point start difference too high
	00001000 00000000	Set point change
	00010000 00000000	Current too low
	00100000 00000000	Max. breakaway time exceeded
	01000000 00000000	Perm. time until CLOSED position exceeded
10000000 00000000	Canceled by supply pressure	

### 6) TROVIS 3730-3

Byte	Bit	Message description	Local operation
0	Bit 0	Fail-safe position mode	Error ID: 29
	Bit 1	Init: travel too small	Error ID: 2
	Bit 2	Init: rated travel not achieved	Error ID: 1
	Bit 3	Init: no movement	Error ID: 3
	Bit 4	Init: pin position	Error ID: 27
	Bit 5	Init: canceled (control accuracy)	Error ID: 2641
	Bit 6	Init: low control accuracy	Error ID: 2644
	Bit 7	Positioner not initialized	Error ID: 27
1	Bit 0	Init: canceled externally	Error ID: 32
	Bit 1	Init: angle limitation	Error ID: 2643
	Bit 2	Init.: timeout	Error ID: 2645
	Bit 5	Timeout for detection of zero	Error ID: 26
	Bit 6	Zero shift too large	Error ID: 36
2	Bit 0	Options: Combination of options invalid	Error ID: 162
	Bit 1	Options: Switch position for forced venting function incorrect	Error ID: 201

Byte	Bit	Message description	Local operation
3	Bit 0	Binary input option A active	Error ID: 160
	Bit 3	Binary input option B active	Error ID: 161
	Bit 6	External position sensor error	Error ID: 221
4	Bit 0	Operating mode not AUTO	Error ID: 150
	Bit 2	Forced venting function	Error ID: 157
	Bit 4	Main function running	–
	Bit 6	Emergency mode active	Error ID: 211

7) TROVIS 3730-3

Byte	Bit	Message description	Local operation
20	Bit 0	AMR signal outside range	Error ID: 198
	Bit 1	Hardware error	–
	Bit 2	Limit for total valve travel exceeded	Error ID: 156
21	Bit 0	Lower end position shifted	Error ID: 195
	Bit 1	Upper end position shifted	Error ID: 196
	Bit 5	Dynamic stress factor exhausted.	Error ID: 155
22	Bit 0	Set point deviation	Error ID: 194
	Bit 1	Brownout	Error ID: 149
22	Bit 2	Shifting working range: operating range is shifting towards the minimum OPEN position	Error ID: 224
	Bit 3	Shifting working range: operating range is shifting towards the maximum OPEN position	Error ID: 225
	Bit 4	Working range in closed position	Error ID: 222
	Bit 5	Working range in max. OPEN position	Error ID: 223
	Bit 6	Limited working range: lower range	Error ID: 226
	Bit 7	Limited working range: upper range	Error ID: 227
23	Bit 0	Current too low	Error ID: 153
	Bit 1	IP shutdown	Error ID: 148
	Bit 2	Current too high	Error ID: 154
	Bit 5	Temperature inside device below min. limit	Error ID: 144
	Bit 6	Temperature inside device above max. limit	Error ID: 145
24	Bit 0	Init: angle limitation	Error ID: 2643
	Bit 4	Logging in EEPROM suspended	–

8) TROVIS 3973 and TROVIS SAFE 3793:

## Universal commands

Byte	Bit	Message description	Local operation
0	Bit 0	Incorrect operating mode	Menu 10.1.1.4
	Bit 1	Travel too small	Menu 10.1.1.6
	Bit 2	Rated travel not achieved	Menu 10.1.1.8
	Bit 3	No movement	Menu 10.1.1.10
	Bit 4	Pin position	Menu 10.1.1.12
	Bit 5	Canceled (control accuracy)	Menu 10.1.1.14
	Bit 6	Low control accuracy	Menu 10.1.1.16
	Bit 7	Positioner not initialized	Menu 10.1.1.18
1	Bit 0	Initialization canceled (external)	Menu 10.1.1.19
	Bit 1	Angle limitation	Menu 10.1.1.21
	Bit 2	Timeout	Menu 10.1.1.23
	Bit 5	Timeout for detection of zero	–
	Bit 6	Zero shift too large	–
2	Bit 0	P3799: combination	Menu 10.1.1.26
	Bit 1	No pneumatic module installed	Menu 10.1.1.27
	Bit 4	Combination Z3799	Menu 10.1.1.30
	Bit 5	Forced venting switch incorrect	Menu 10.1.1.31
2	Bit 6	Leakage sensor limit 1 exceeded	–
	Bit 7	Leakage sensor limit 2 exceeded	–
3	Bit 0	Slot C.1: binary input active	Menu 10.1.1.32
	Bit 1	Slot C.2: binary input active	Menu 10.1.1.33
	Bit 2	Slot C.3: binary input active	Menu 10.1.1.34
	Bit 3	Slot D.1: binary input active	Menu 10.1.1.35
	Bit 4	Slot D.2: binary input active	Menu 10.1.1.36
	Bit 5	Slot D.3: binary input active	Menu 10.1.1.37
	Bit 6	External position sensor error	–
4	Bit 0	Operating mode not AUTO	Menu 10.1.1.39
	Bit 2	Forced venting function	Menu 10.1.1.40
	Bit 4	Main function running	–
	Bit 6	Emergency mode active	Menu 10.1.1.42
	Bit 7	Fail-in-place module has been activated	–



Byte	Bit	Message description	Local operation
5	Bit 0	Friction change (open position)	Menu 10.1.1.45
	Bit 1	Friction change (mid-position)	Menu 10.1.1.46
	Bit 2	Friction change (closed position)	Menu 10.1.1.47
	Bit 5	Fail-in-place module error	–

9) TROVIS 3793 and TROVIS SAFE 3793

Byte	Bit	Message description	Local operation
14	Bit 0	Pressure sensor failure	Menu 10.1.1.28
	Bit 4	Valve signature failed	Menu 10.1.1.48
15	Bit 0	No supply pressure	Menu 10.1.1.50
	Bit 1	Low supply pressure	Menu 10.1.1.51
	Bit 2	Supply pressure > 10 bar	Menu 10.1.1.52
16	Bit 0	PST: cancellation criteria met	Menu 10.1.1.54
	Bit 1	PST: start criteria not met	Menu 10.1.1.55
17	Bit 0	FST: cancellation criteria met	Menu 10.1.1.57
	Bit 1	FST: start criteria not met	Menu 10.1.1.58
18	Bit 0	Failure (spool valve)	–
	Bit 1	No air (spool valve)	–
	Bit 2	Maintenance required (spool valve)	–
	Bit 3	Initialization (spool valve)	–
19	Bit 0	Failure (spool valve)	–
	Bit 1	No air (spool valve)	–
	Bit 2	Maintenance required (spool valve)	–
	Bit 3	Initialization (spool valve)	–
20	Bit 0	AMR signal outside range	Menu 10.1.1.77
	Bit 1	Hardware error	Menu 10.1.1.79
	Bit 5	Limit for total valve travel exceeded	Menu 10.1.1.80
21	Bit 0	Lower end position shifted	Menu 10.1.1.81
	Bit 1	Upper end position shifted	Menu 10.1.1.82
	Bit 5	Dynamic stress factor exceeded	Menu 10.1.1.83

## Universal commands

Byte	Bit	Message description	Local operation
22	Bit 0	Set point deviation	Menu 10.1.1.86
	Bit 1	Brownout	Menu 10.1.1.87
	Bit 2	Operating range shifting towards CLOSED position	–
	Bit 3	Operating range shifting towards max. OPEN position	–
	Bit 4	Operating range in CLOSED position	–
	Bit 5	Operating range in max. OPEN position	–
	Bit 6	Limited working range: lower range	–
	Bit 7	Limited working range: upper range	–
23	Bit 0	Current too low	Menu 10.1.1.89
	Bit 1	IP shutdown	Menu 10.1.1.90
	Bit 2	Current too high	Menu 10.1.1.91
	Bit 5	Temperature inside device below min. limit	Menu 10.1.1.94
	Bit 6	Temperature inside device above max. limit	Menu 10.1.1.95
24	Bit 0	Angle limitation	Menu 10.1.1.92
	Bit 4	Logging suspended	Menu 10.1.1.96

## 3.7 Start and analysis of the partial stroke test (PST)

Types 3730-3 and 3731-3 as well as TROVIS SAFE 3731-3

	Send		Receive
	Byte 1	Byte 2	
Start PST Cmd 168	0x89	–	–
Stop PST Cmd 168	0x9D	–	–
PST information Cmd 171	0x01	0x19	0/1: PST not active/is performed
PST status Cmd 161	0x00	0xD9	Refer to Table 9

### PST measurement results (current test)

- Command 181 Subcommand 467  
Byte 0 –

- Byte 1 to 4: Dead time (increasing)
- Command 181 Subcommand 468
  - Byte 0 -
  - Byte 1 to 4: T63 (increasing)
- Command 181 Subcommand 469
  - Byte 0 -
  - Byte 1 to 4: T98 (increasing)
- Command 181 Subcommand 470
  - Byte 0 -
  - Byte 1 to 4: Rise time (increasing)
- Command 181 Subcommand 471
  - Byte 0 -
  - Byte 1 to 4: Settling time (increasing)
- Command 151 Subcommand 290 (float)
  - Byte 0 -
  - Byte 1 to 4: Overshooting (increasing)
- Command 181 Subcommand 472
  - Byte 0 -
  - Byte 1 to 4: Dead time (decreasing)
- Command 181 Subcommand 473
  - Byte 0 -
  - Byte 1 to 4: T63 (decreasing)
- Command 181 Subcommand 474
  - Byte 0 -
  - Byte 1 to 4: T98 (decreasing)
- Command 181 Subcommand 475
  - Byte 0 -
  - Byte 5 to 8: Rise time (decreasing)
- Command 181 Subcommand 476
  - Byte 0 -
  - Byte 9 to 12: Settling time (decreasing)
- Command 151 Subcommand 296 (float)
  - Byte 0 -
  - Byte 1 to 4: Overshooting (decreasing)

## Universal commands

**Table 9:** *PST status (the description applies when the bit is set to 1)*

Bit	Description
00000000 00000001	No PST performed
00000000 00000010	PST completed successfully
00000000 00000100	x cancellation
00000000 00001000	y cancellation
00000000 00010000	Tolerance band exceeded
00000000 00100000	Max. test duration exceeded
00000000 01000000	Test canceled manually
00000000 10000000	Measured data memory full
00000001 00000000	Cancel internal solenoid valve/forced venting
00000010 00000000	Canceled by control loop error
00000100 00000000	Set point start difference too high
00001000 00000000	Set point change
00010000 00000000	Current too low
00100000 00000000	Max. breakaway time exceeded
01000000 00000000	Perm. time until CLOSED position exceeded
10000000 00000000	Canceled by supply pressure

**Type 3730-6 and TROVIS SAFE 3730-6**

	Send		Receive
	Byte 1	Byte 2	
Start PST Cmd 168	0x89	–	–
Stop PST Cmd 168	0x9D	–	–
PST information Cmd 171	0x01	0x19	0/1: PST not active/is performed
PST measurement result Cmd 157	0xA4	–	Refer to Table 10
PST status Cmd 48	0x00	0xD9	See page 22 ff.

**Table 10:** *PST measurement results*

Byte	Measurement result
Byte 0	–
Byte 1 to 4	Overshooting (increasing)
Byte 5 to 8	Dead time (increasing)
Byte 9 to 12	–
Byte 13 to 16	T86 (increasing)
Byte 17 to 20	Settling time (increasing)
Byte 21 to 24	–
Byte 25 to 28	Overshooting (decreasing)
Byte 29 to 32	Dead time (decreasing)
Byte 33 to 36	–
Byte 37 to 40	T86 (decreasing)
Byte 41 to 44	Settling time (decreasing)

**TROVIS 3730-3**

No universal command to start and analyze the partial stroke test (PST) exists.

# KH 8384-3 EN

## TROVIS 3793 and TROVIS SAFE 3793

No universal command to start and analyze the partial stroke test (PST) exists.



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