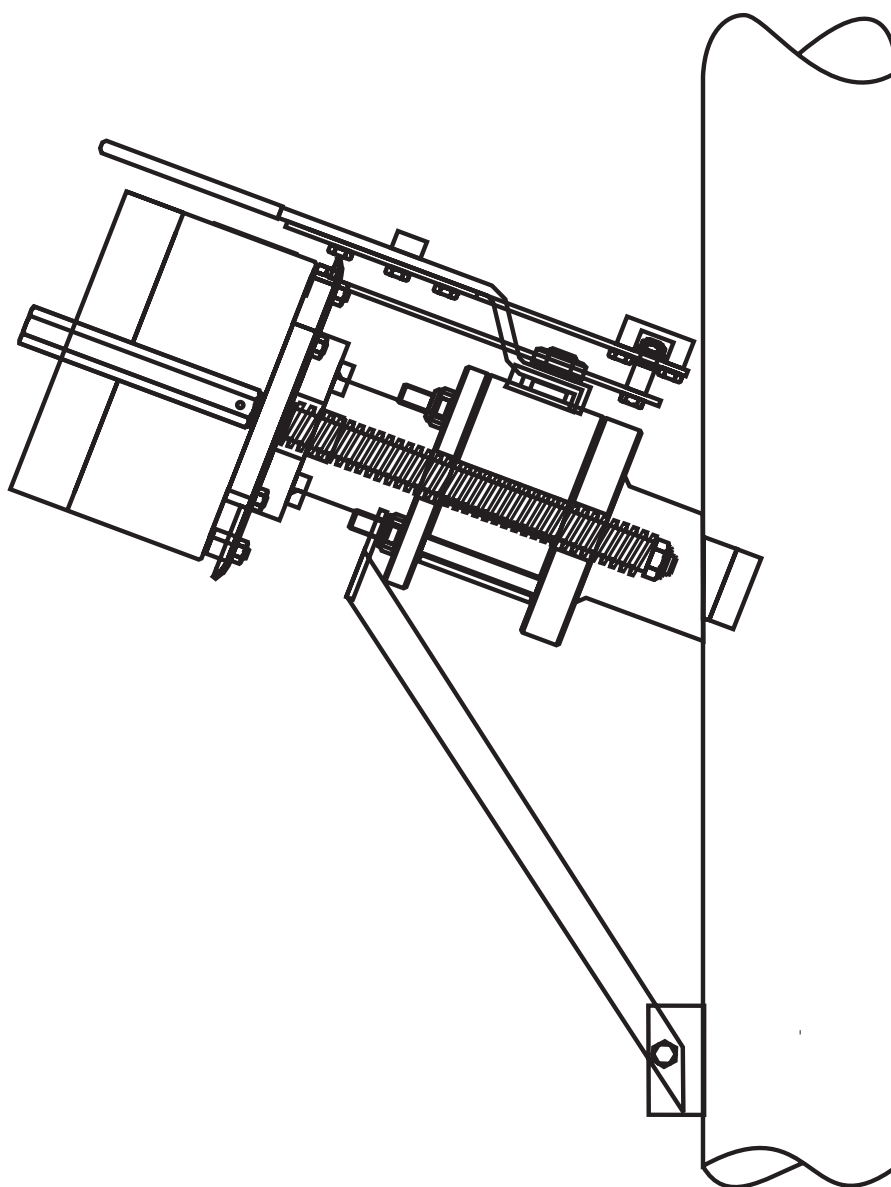


# Pulptec™ BT-5400

Brightness Transmitter



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## Disclaimer

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# 1 Product Introduction

## 1.1 General

The BT-5400 is designed for monitoring pulp bleaching in distributed control, supervisory or stand-alone applications. Due to a unique method of measuring brightness and a user-programmable algorithm, the BT-5400 can calculate compensated brightness signals that consider variables and inputs from a variety of process measurements.

The BT-5400 is available in a UV (Ultra Violet) light source variant for measurement of fluorescence.

There are five analog output signals specifically designed for brightness and color measuring, including ERIC (Effective Residual Ink Count) and fluorescence (UV).

BT-5400 is a part of the BTG's "smart transmitter" product line. It is an intelligent, microprocessor-based transmitter that, in conjunction with the hand-held terminal SPC-1000, can be connected at any point on the 4-20 mA output signal loop.

Calibration is done using a PC software, called BT-Calibration.

The BT-5400 is mounted through a ball valve assembly (SS 2343 or titanium grade 2) to a weld-in stud or FRP stud. The BT-5400 can be used to measure brightness and color in all types of bleaching process. It is suitable for both mechanical pulps (TMP, CTMP, groundwood), and chemical pulps (kraft), and in recycled fiber deinking.

When brightness measurements are used to control chemical additions, variations in reaction rate due to changes in temperature, pH and chemical concentration become more important. Changes in reaction parameters must be compensated. Time effects such as production rate and stock flow must also be taken into account. The BT-5400's built-in temperature transmitter can be used for brightness signal compensation, temperature control or merely observation purposes.

### 1.1.1 Measuring Principle

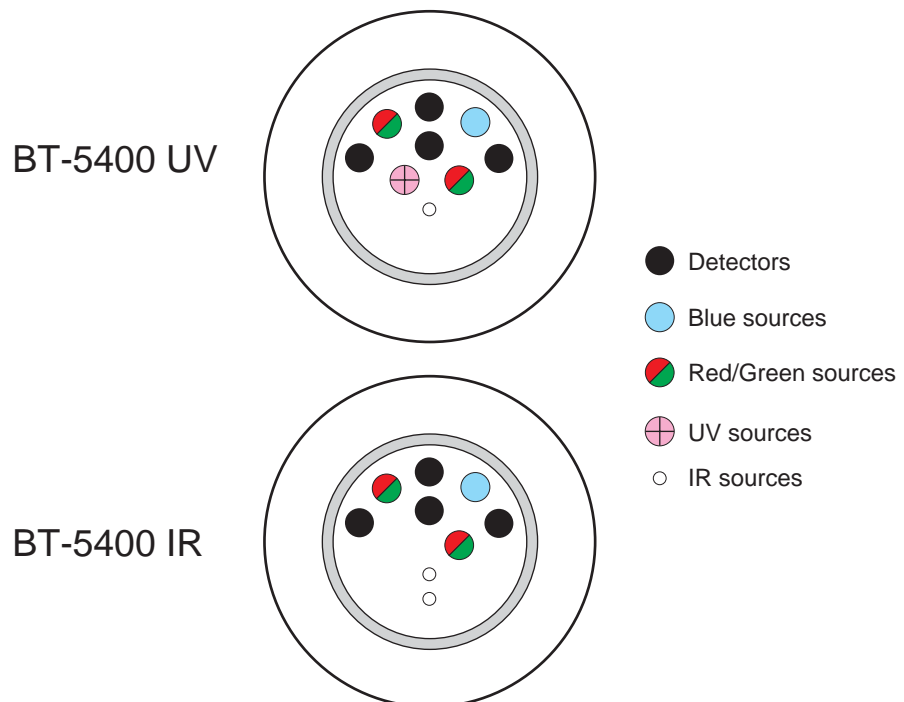
Pulp properties is measured at four (five for UV) discrete wavelengths. This is done by pulsing four (five for UV) groups of LEDs which are exemplary light sources thanks to their longevity, predictable beam pattern and monochromatic output, therefore no need for rotating color filters and motors. Color, brightness, ERIC, and fluorescence (UV) with their different requirement on applied wavelength can be measured. In BT-5400 the four wavelengths can be combined to find the optimum correlation to lab in a specific application.

Light from the LEDs is directed into the process stream via flexible transmitting fiber optics. It passes through the probe window and is diffused by the pulp or other medium. The scattered light is then gathered by receiving fiber optics and conducted to a photo detector.

Optical feedback and software control routines, based on the tried and tested BTG 4-Beam<sup>TM</sup> Principle that minimizes drift due to temperature or aging of optical components, enable continuous compensation for changes in process temperature and allow for inevitable degradation of signal sources and detectors. These active equalization techniques give the signal stability needed.

The UV-channel in the BT-5400 UV measures fluorescence, which may appear from FWA (Fluorescent Whitening Agents) present in the pulp. An optical filter is used in front of the detector transmitting only the part of the emitted UV-light which is reflected in the visible wavelength region. Thus, the part of the UV-light which is reflected as UV is removed. Subsequently, pulps without FWA will have a measured signal at zero, or very close to zero, for the UV channel.

**Fig 1 BT-5400 probe source/detector arrangement**



## 1.2 Technical Data

### General

**Manufacturer**

BTG, Säfte, Sweden

**Quality Assurance**

ISO 9001

**Product Safety**

Fulfills all relevant CE, UL, and CSA standards.

### Functional Specification

#### Measuring Data

**Measuring Range**

Approx. 5-96 ISO

**Temperature Measurement**

Process temp. accuracy  $\pm 0.8^{\circ}\text{C}/1.5^{\circ}\text{F}$

Internal temp. accuracy  $\pm 1^{\circ}\text{C}/1.8^{\circ}\text{F}$

**Damping**

Mean value of 0-40 measuring cycles.

**Measuring Cycle**

Maximum 6 s

**Event Log**

Maximum 40 events are stored.

#### Signalling Data

**Alarm Signal**

Output signal at measuring span limits.

Also accessible via the communications link.

#### Vibration Testing

**Resonance Frequency**

160-170Hz and 450-500Hz within 4-600Hz

#### Source Data

**Light Source**

Light emitting diode

#### Detector Data

**Photo Detectors**

Photodiode (semi-conductor)

## Process Specification

### Process Limits

ANSI 150

PN 16

### Process Temperature Limits

5-120°C (41-248°F)

### Ambient Temperature Limits

0-50°C (32-122°F)

## Performance Specification

### Repeatability

± 0.3 ISO

### Reproducibility

± 0.4 ISO

### Temperature Effect

< -0.05 ISO per °C (°F=°Cx1.8)

## Physical Specification

### Probe

#### Degree of Protection

IP 65 / NEMA 4x

#### Material

Stainless steel SS2343 with EPDM O-rings

Titanium grade 2 with Kalrez O-rings

#### Window Material

Sapphire

#### Electronic Housing Material

FRP

#### Probe Weight

Stainless steel: 6.3 kg (14 lb)

Titanium: 5.0 kg (11 lb)

#### Valve Assembly Weight

Stainless steel: 5 kg (11 lb)

Titanium: 4.3 kg (9.5 lb)

#### Storage Temperature

Minimum: -20°C (-4°F)

Maximum: 70°C (158°F)

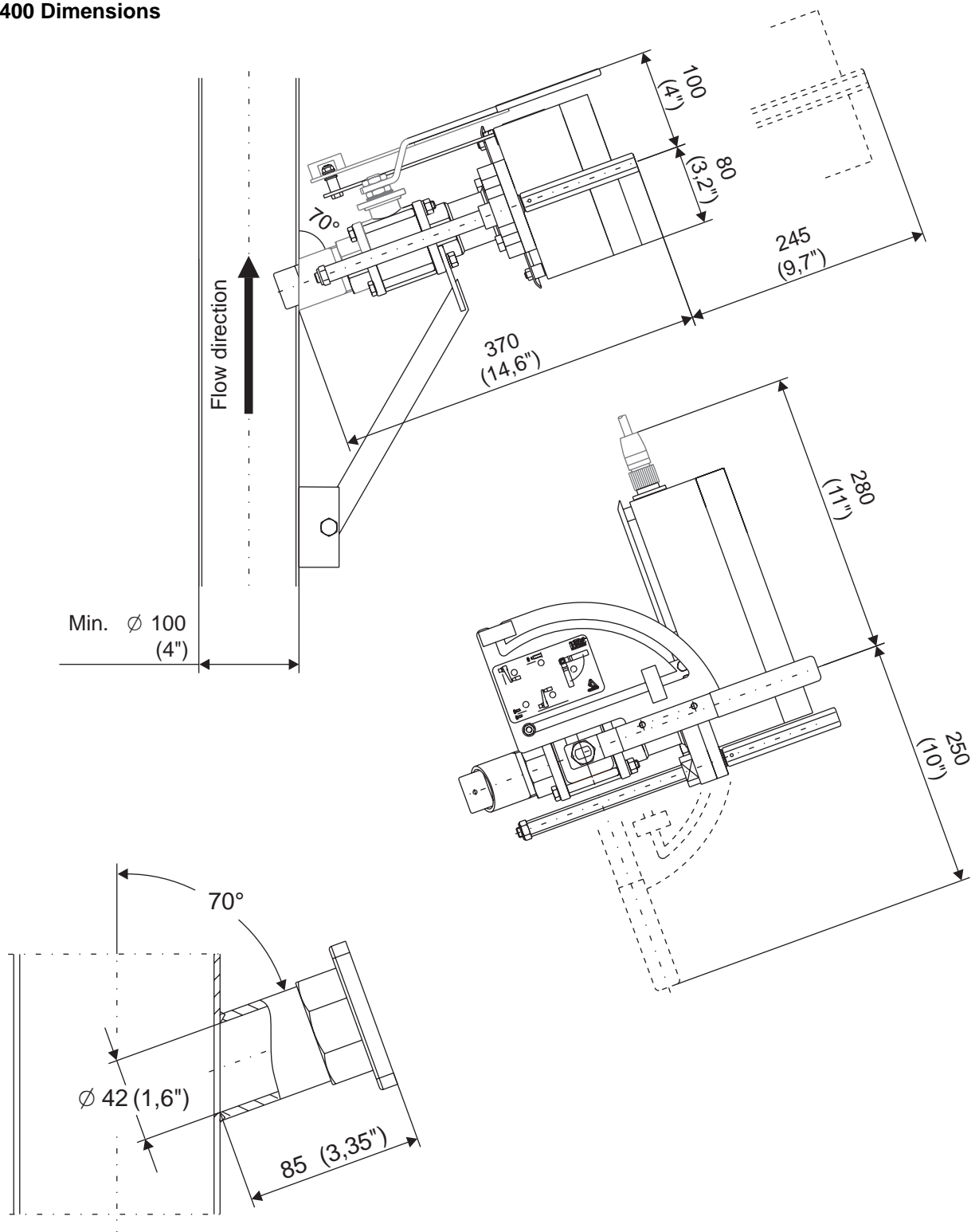
## Junction Box

See section 8.1.2.



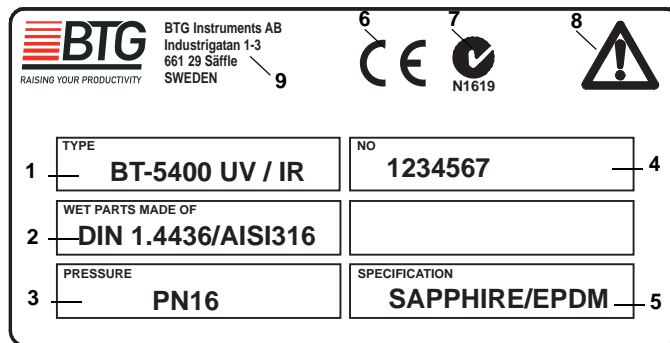
## 1.3 Dimensions and Mounting

Fig 2 BT-5400 Dimensions



## 1.4 Type Sign Explanations

Fig 3 Type sign



### 1. Transmitter model

UV or IR type.

### 2. Wetted parts made of

Stainless steel SS2343 (AISI 316 SS, DIN 1.4436) or Titanium grade 2.

### 3. Pressure

PN 16 = Pressure class rating.

### 4. Manufacturing number

BTG internal product identification number.

### 5. Glass and rubber quality in wetted parts

Probe window = Sapphire.

EPDM = O-rings for stainless steel, pH 8-14.

Kalrez = O-rings for Titanium

### 6. CE-marking

The BT-5400 is approved according to CE directives.

### 7. C-TIC marking

The BT-5400 is approved according to Australian C-TIC N1619 directives.

### 8. Warning sign

The device is designed for industrial use. Installation, handling and service must only be carried out by trained and authorized personnel and according to relevant standards. Read the manual for detailed information and pay special attention to the warning signs!

### 9. Manufacturer

## 2 Safety Instructions

### 2.1 General

These safety regulations are based on a risk analysis carried out in accordance with the requirements of relevant CE directions in order to comply with European standards for CE marking.

In practice, an operating brightness transmitter is only hazardous while covers are removed during installation and service.

Read these safety regulations before installing the transmitter. Follow the regulations when installing the transmitter, starting up and when carrying out service. Use warning signs for safety information!

Mounting parts, such as the weld-in stud, are dealt with in accordance with the pressure vessel standards of the countries in question.

Always take precautions when handling equipment in pressurized pipes.

All installation, operation, service, and other handling must be carried out by trained and authorized personnel and according to valid standards.

---

**NOTE!**

Follow this manual for all installation, operation, and service.

---

---

**NOTE!**

For good personal and functional safety: Use only parts which have been manufactured or approved by BTG.

---

## 2.2 Conventions

The following conventions are used in this manual:

- **DANGER!**

A **DANGER!** admonition is used when there is a hazard with a risk for *injury or possible death* to a person.

- **WARNING!**

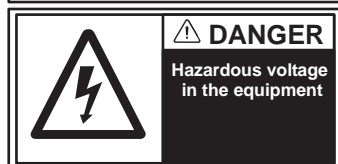
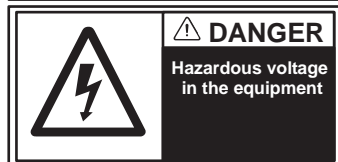
A **WARNING!** admonition is used when there is a risk for *damage* to program, device, machine, sampler and so on.

- **CAUTION!**

A **CAUTION!** admonition is used when there is a risk for *system failure, service interruption, disturbances* to plant operation, a measuring application and so on.

The admonitions above are hierarchic. A **DANGER!** admonition includes the possibility of both a **WARNING!** and a **CAUTION!** admonition.

## 2.3 Safety Regulations



### 2.3.1 Safety Regulations for Installation

All welding must take place in accordance with current standards and regulations.

All handling of electrical units must take place in accordance with current standards and regulations. The junction box should only be connected by a qualified electrician in accordance with instructions. The ground should be connected safely and be checked. It should be possible to switch off the voltage in the distribution center. A clear warning, such as a sign, should let other people know that work is in progress and that the switch must not be touched.

### 2.3.2 Safety Regulations for Service

All handling of electrical units must take place in accordance with current standards and regulations. The junction box should only be connected by a qualified electrician in accordance with instructions.


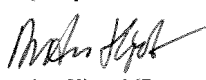
Before removing the probe from the valve assembly, verify that the valve is closed. Hot or corrosive liquid that leaks out while under high pressure may cause serious chemical burn injuries!

## 2.4 CE declaration

When using the units in other combinations than tested for, BTG can not guarantee the CE directive conformity.

The units in combination with customer installed external devices may conform with EMC and safety requirements when properly installed and using an adequate CE marked equipment.

**The system operator is responsible for the CE directive conformity. The conformity must be verified by inspection.**

		 <small>RAISING YOUR PRODUCTIVITY</small>
<b>CE Declaration of Conformity</b>		
According to EN 45014		
<b>Manufacturer's Name</b> <b>Manufacturer's Address</b> declares that the product: <b>Product Name</b> <b>Model Number</b> complies with the amendments and requirements of the:	BTG Pulp & Paper Sensors AB P.O. Box 602 S- 661 29 SÄFFLE, Sweden  Brightness Transmitters BT-5300/BT-5400  <b>Low Voltage Directive</b> 73/23/EEC <b>EMC Directive</b> 89/336/EEC <b>PED Directive</b> 97/23/EEC <b>RoHS</b> 2002/95/EC <b>WEEE</b> 2002/96/EC	
and conforms with the following product standards and the PED conformity assessment procedure		
<b>Safety</b>  <b>LVD</b> <b>ETL Reg. No. 401689</b> <b>Low Voltage Power Supply</b>  <b>EMC</b>  <b>PED</b>  <b>CSA/CRN 0C11058.5</b>  <b>WEEE</b> <b>RoHS</b>  <b>Quality System</b>  <b>Säffle,</b> <b>March 2007</b>	EN ISO 12100-1  EN 61010-1 CAN/CSA-C22.2 No. 1010.1-92 NEC Class 2/IEC 60950/IEC 60601  EN 61000-6-4:99 EN 61000-6-2:04  <b>Pressure equipment for piping.</b> In accordance to Article 1, Table 9, art.3 (3), Annex II (Sound eng. practise) <b>Must not bear CE-marking</b> <b>Sluis valve device acc. to ASME</b>  -n.a.-, not Annex I -n.a.-  ISO 9001 monitored by Lloyd's Register Quality Assurance  <div style="text-align: right;">           Anders Hjort, MD       </div>	

## 3 Installation Instructions

### 3.1 Unpacking

The following is included in a BT-5400 delivery:

1. 1 x Measuring probe
2. 1 x BT-5400 test report
3. 1 x Reference kit
4. 1 x Ball valve
5. 1 x Brace
6. 1 x Block wrench (17 mm)
7. 1 x Weld-in stud
8. 1 x Transmitter cable
9. 1 x JCT-1100 electronics box
10. 1 x Hand held terminal, SPC-1000
11. 1 x User manual
12. 1 x BT-Calibration installation CD

### 3.2 Welding Instructions

#### 3.2.1 Stainless Steel Weld-in Stud Installation

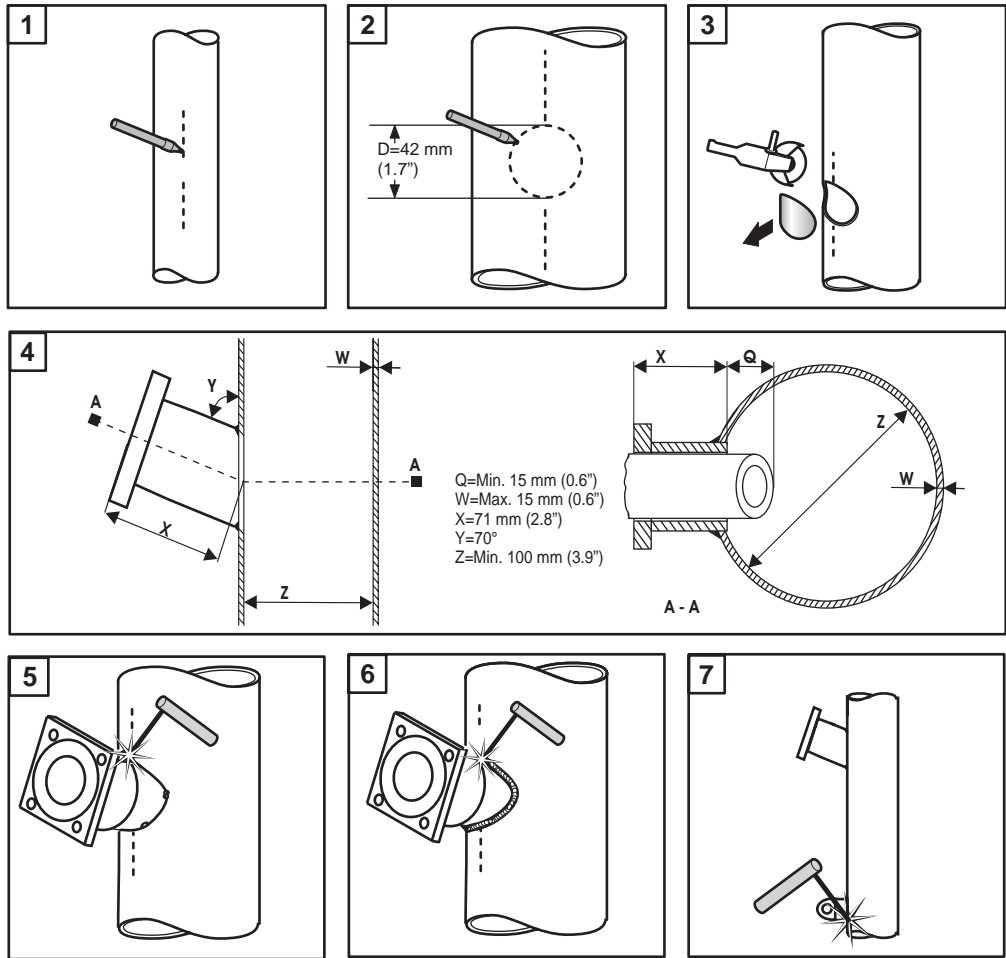
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**NOTE!**

Pipe thickness shall not be more than 15 mm.

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### 3.2 - Welding Instructions

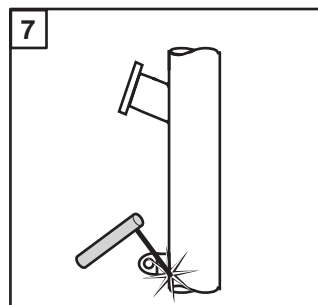
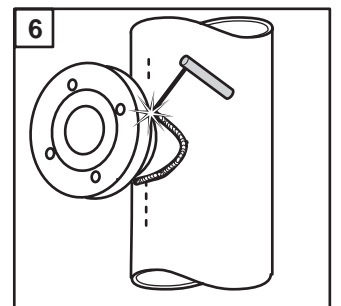
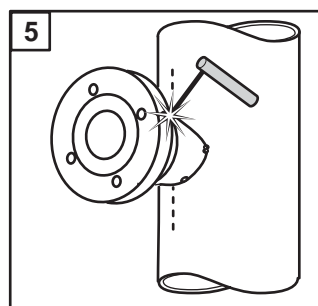
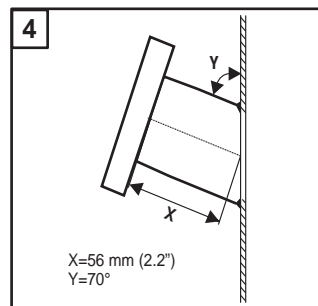
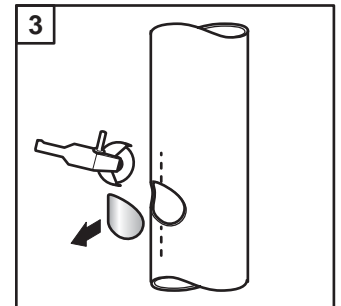
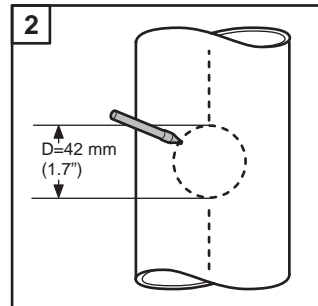
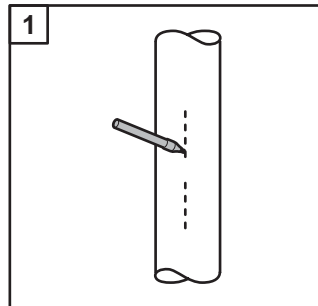




## 3.2.2 SMO 254 and Titanium Weld-in Stud Installation

### NOTE!

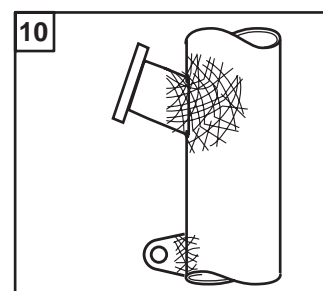
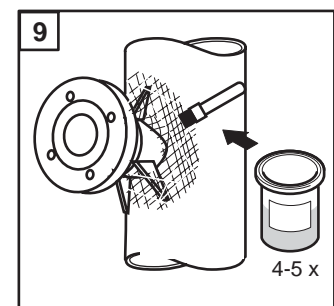
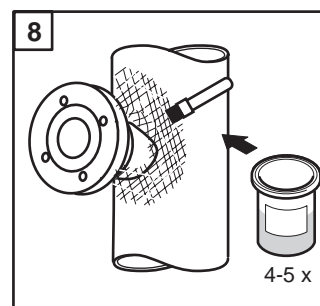
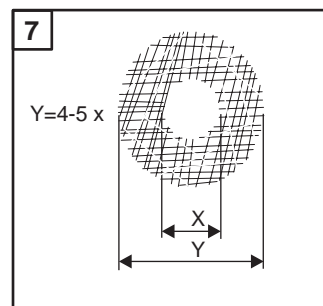
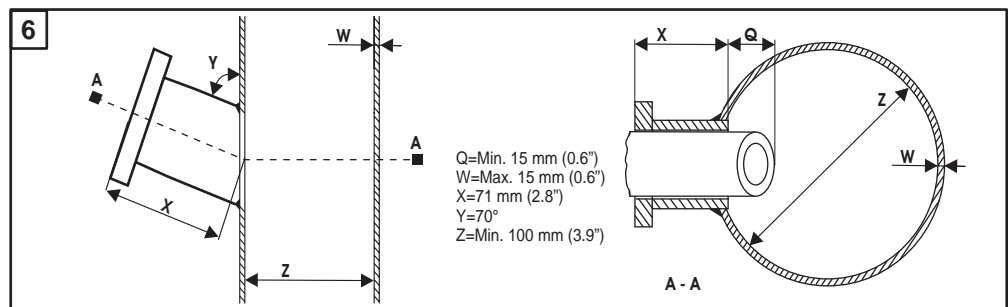
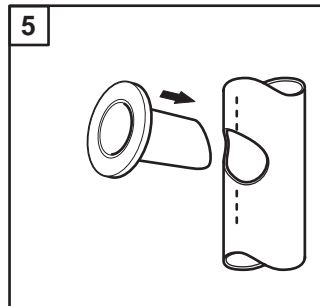
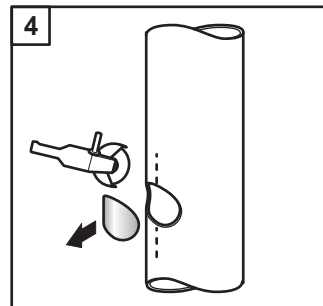
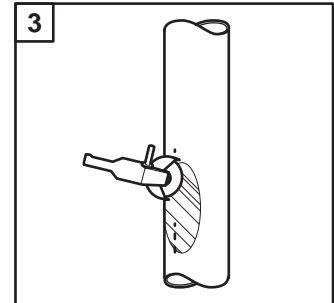
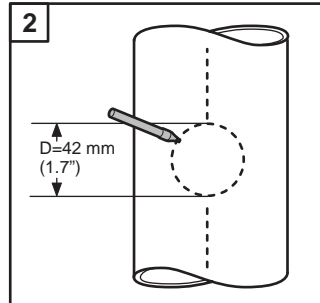
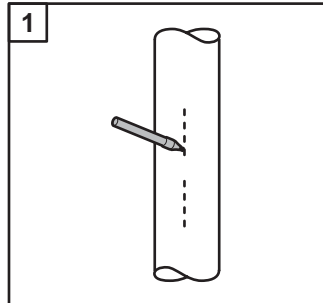
Pipe thickness shall not be more than 15 mm.



### 3.2.3 FRP Stud Installation

**NOTE!**

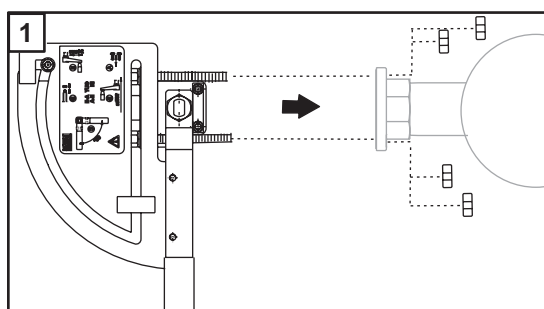
Pipe thickness shall not be more than 15 mm.



## 3.3 Mounting Instructions

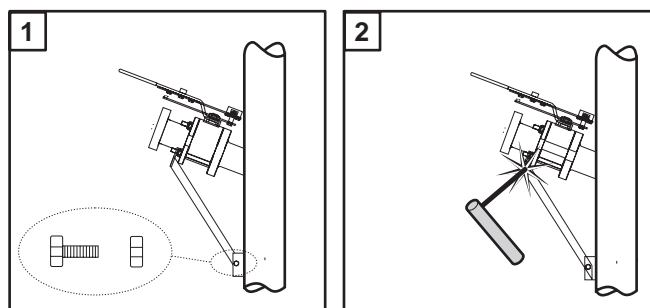
### 3.3.1 Mounting the Sluice Valve

<b>Tools required:</b>
Spanner



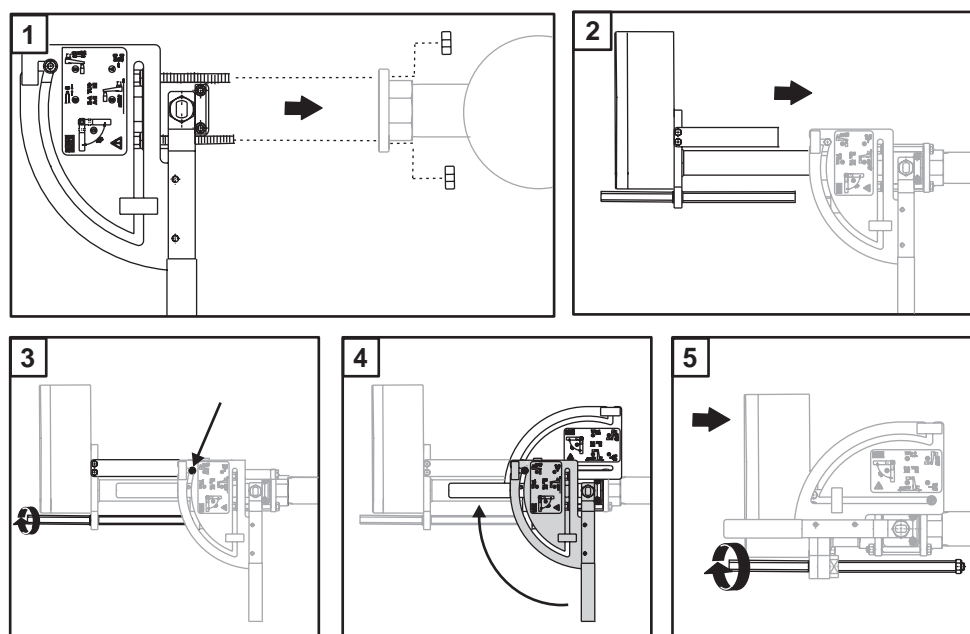
### 3.3.2 Mounting the Brace

<b>Tools required:</b>
Spanner Weld equipment



### 3.3.3 Mounting the Probe

<b>Tools required:</b>
Spanner
<b>Parts required:</b>
1 x Sealing kit, Article no. 84514280



## 3.4 Connection Instructions

### 3.4.1 Electric Connection

See section 8.3.

## **4 Operation Instructions**

### **4.1 Hand-held Terminal SPC-1000**

For more information about the SPC-1000, see section 7.4.

## 4.2 Commissioning

### 4.2.1 Startup

When you are confident that your BT-5400 has been correctly installed and you are ready to power up the system for calibration and/or testing, you should run through this brief check list before powering up. Using this list can help ensure trouble-free initialization of your system.

#### NOTE!

To ensure that the ball valve assembly and the probe are correctly installed and free from leakage it is recommended that you pressure test the system with water.

The pressure should be kept higher than the rating according to applicable regulations.

1. Ensure that the system is turned **OFF** before attaching the system cable to the transmitter.

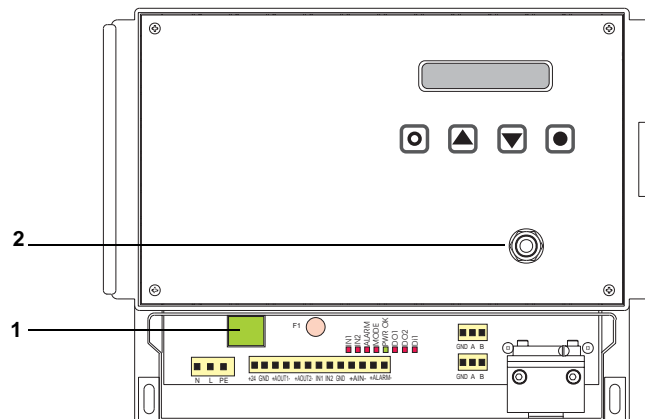
#### NOTE!

Tighten the system cable contact securely!

2. Check all wiring.
3. Install the brightness transmitter BT-5400.
4. Remove the lower cover of the electronics box, power up the transmitter, and reattach the cover.

**Fig 4 Electronics box**

- 1 Power button
- 2 SPC-1000 connection



5. Connect the SPC-1000 hand-terminal to the front of the electronics box and power up the SPC-1000.
6. Press **BT-5400** (version 1.0 and higher) to enter the BT-5400 main menu.
7. Press **Read data** to make sure the transmitter and the SPC-1000 are synchronized. Use analog output 1 for brightness (blue LED).
8. Press the **Yes** button.
9. Wait 3-5 minutes.
10. Check that **Edit range** button is 1 and that the square in the lower right hand corner of the SPC-1000 shows **A.out 1**.

11. Find out the expected brightness in the process.
12. Look at the square in the lower right hand corner. Read the ISO value. Add an offset so that the output signal agrees with the brightness expected in the process.
13. Press the **Offset** button .
14. Enter the calculated offset value and press the **Enter/Menu** button.
15. Press the **Send data** button and then the **Send change** button.
16. Enter the code **42600** and press the **Enter/Menu** button (only needed if send code is ON).

#### 4.2.2 Set Time, Date and Supply Frequency

1. From the main menu, press **Configure** button.
2. Enter code **5400** and press **Enter/Menu** button.
3. Press **Config.setup**.
4. Press **Set clock**.
5. Enter the correct date and time and press the **Enter/Menu** button.
6. Check that the correct supply frequency is set (50 or 60 Hz), or edit by toggle the **Supply freq.** button.
7. Press the **Send page** button and then the **Send change** button.
8. Enter the code **42600** and press the **Enter/Menu** button (only needed if send code is ON).

### 4.2.3 Select Range or Alarm Function

It must be decided if external measuring range selection inputs or alarm output is needed in the BT-5400 application. The two functions share the same connection points in the JCT-1100 and one must be selected if to be used.

If range inputs are selected this means that the BT-5400 uses two external range selector inputs to select measuring range (pulp quality). In this case, no alarm output exists.

If alarm output is selected, this means that external measuring range selection is not possible, but can be done manually from the SPC-1000 if needed.

1. From the SPC-1000 main menu, press **Configure** button.
2. Enter code **5400** and press **Enter/Menu** button
3. Press **Config.setup**.
4. Press **Range** button.

---

**NOTE!**

The **Range** button is only visible if **Mode** is set to **ALARM**.

---

In this case the BT-5400 is configured to handle an alarm output.

Depending on the chosen function, the white eight-pole connector on the circuit board inside the BT-5400 has to be placed accordingly, in either Alarm or Range position. Open the BT-5400 casing to get access to the connector.

1. From the SPC-1000 main menu, press **Configure** button.
2. Enter code **5400** and press **Enter/Menu** button
3. Press **Config.setup**.
4. Select the desired function with **Mode**.
5. Send changes to BT-5400 by pressing **Send page** button and then the **Send change** button.
6. Enter the code **42600** and press the **Enter/Menu** button (only needed if send code is ON).

---

**NOTE!**

Default setting at delivery is Range.

---



## 4.3 Precalibration

This section describes the procedure for precalibration and how to check the reference calibration of the BT-5400.

Since the UV-channel measures only the fluorescence component of the reflectance, it must be calibrated using a different reference than the other channels; a fluorescent paper. For the 'high' reference, this paper is put on the probe tip with the common reference cylinder then put on top of it, and for the 'low' reference the dark side of the reference is used, without the paper. The value to be used for the 'high' reference thus is the fluorescence component of the brightness of the standard fluorescent paper, typically approximately 10 % ISO, and the value for the 'low' reference is zero, corresponding to no fluorescence.

### 4.3.1 Calibrate using Reference

This section describes the procedure for precalibration of the BT-5400 using reference cylinder with high and low brightness. For the BT-5400 UV variant the UV-channel uses a fluorescent paper to add on the reference for the high level of brightness.

#### Prerequisites:

- BT-5400 has been mounted and in contact with the process for at least three hours and has the same temperature as the process.
1. Remove the BT-5400 from the process.
  2. Wipe the probe window with a cotton cloth.
  3. From the SPC-1000 main menu, press **Calibr.** button.
  4. Enter code **5400** and press **Enter/Menu** button.
  5. Press the **Ref.Calib.** button.
  6. Put the reference with the highest ISO value on the probe tip.

---

#### NOTE!

The side with the white plastic inside the reference cylinder is the highest ISO value.

---

7. Wait two minutes for the signal to stabilize.
8. Press **Next Column** button until the cursor is placed in the **High probe** column.
9. Check that the signal is stable, then press **Copy meas** button to copy the measured signal to the **High probe** column.
10. Press **Next row** button.
11. Check that the signal is stable, then press **Copy meas** button to copy the measured signal to the **High probe** column.

---

#### NOTE!

For the **UV** -channel use a fluorescent paper from the black plastic box on the probe tip and the reference cylinder on top of the paper.

---

12. Repeat step 8 and 9 until measured signals are registered for **BLUE, RED, GREEN, N.IR,** and **F.IR/UV** in the **High probe** column.

13. Press **Next Column** button once so the cursor is placed in the **Lab** column.
14. Press the **Edit** button.
15. Enter the high ISO value noted in the test report (Reference measurement Lab) for the reference. Press **Enter/Menu** button (for the UV-channel the value with the fluorescent paper).
16. Press **Next row** button.
17. Enter the high ISO value noted for the reference. Press **Enter/Menu** button.
18. Repeat step 14 and 15 until all **Lab** values are entered.
19. Press the **Send** button and then the **Send change** button .
20. Enter the code **42600** and press the **Enter/Menu** button (only needed if send code is ON).
21. Turn the reference cylinder on the probe tip so the lower ISO value is used.
22. If used, put the fluorescent paper back into the black plastic box.

---

**NOTE!**

The side with the dark plastic inside the reference cylinder is the lower ISO value.

For the **UV** -channel the fluorescent paper is **not** used for the lower value.

---

23. Wait two minutes for the signal to stabilize.
24. Press **Next Column** button until the cursor is placed in the **Low probe** column.
25. Repeat step 7 to step 18. Note that when entering **Lab** values the **Low** reference values must be used, from the test report (Reference measurement Lab).
26. Mount the BT-5400 in the process.

---

## 4.3.2 Check Reference Calibration

### Prerequisites:

- BT-5400 has been mounted and in contact with the process for at least three hours and has the same temperature as the process.
- All **Meas Probe** values + **M.temp** have been noted.

1. Remove the BT-5400 from the process.
2. Wipe the probe window with a cotton cloth.

---

### NOTE!

Warm probe and a cold reference can lead to condensation on the probe window.

---

3. From the SPC-1000 main menu, press **Ref.Check** button.
4. Put the reference with the highest ISO value on the probe tip.

---

### NOTE!

The side with the white plastic inside the reference cylinder is the highest ISO value.

For the **UV** -channel use a fluorescent paper from the black plastic box on the probe tip and the reference cylinder on top of the paper.

---

5. Wait two minutes for the signal to stabilize.
6. Compare the **Meas.Probe** value with the **High Probe** value.  
Maximum difference should not exceed  $\pm 0.5$  ISO.
7. If used, put the fluorescent paper back into the black plastic box.

---

### NOTE!

The side with the dark plastic inside the reference cylinder is the lower ISO value.

For the **UV** -channel the fluorescent paper is **not** used for the lower value.

---

8. Turn the reference on the probe so the lower ISO value is used.
9. Wait two minutes for the signal to stabilize.
10. Compare the **Meas.Probe** value with the **Low Probe** value.  
Maximum difference should not exceed  $\pm 0.5$  ISO.

---

### NOTE!

If the values differ more than  $\pm 0.5$  ISO, check the probe window for dirt or condensation and repeat this check. If the values still differ, do a new reference calibration.

---

---

## 4.4 Configure

This chapter describes how to configure the BT-5400 for brightness, ERIC, lightness, redness, yellowness, and if applicable UV -measurement.

### 4.4.1 Configure Brightness Measurement

**Prerequisites:**

- BT-5400 has been mounted and in contact with the process for at least three hours and has the same temperature as the process.
- Reference calibration and reference check have been performed.

---

**NOTE!**

To demonstrate the brightness configuration process, hypothetical lab samples are used with a lab value of 80 ISO

---

1. Take a physical sample for lab analysis.
2. On the SPC-1000 view **A.out1** (MIX, that means blue led) and read the measured value.  
Example: 40 ISO
3. Calculate the difference between the lab value and the measured value.  
Example: 80-40= 40 ISO.
4. Press the **Offset** button.
5. Enter the calculated offset value. Example: 40.
6. Press the **Enter/Menu** button.
7. Press the **Send data** button and then the **Send change** button.
8. Enter the code **42600** and press the **Enter/Menu** button (only needed if send code is ON).

---

## 4.4.2 Configure ERIC Measurement

### Prerequisites:

- BT-5400 has been mounted and in contact with the process for at least three hours and has the same temperature as the process.
- Reference calibration and reference check have been performed.

---

### NOTE!

To demonstrate ERIC configuration, hypothetical lab samples are used with a lab value of 300 ppm.

---

1. From the SPC-1000 main menu, press **Configure** button.
2. Enter code **5400** and press **Enter/Menu** button.
3. Press **Config.setup** button.
4. Choose an analog out signal. In this example **A.out 2** is used.
5. Toggle the **A.out 2** button until **MIX** is selected.
6. Toggle the **Unit** button until **PPM** is selected.
7. Enter the following values:

Mix BLUE	0
Mix RED	0
Mix GREEN	0
Mix N.IR	-20
Mix F.IR/UV	0
Offset	1000

8. Press the **Send page** button and then the **Send change** button.
9. Enter the code **42600** and press the **Enter** button (only needed if send code is ON).
10. Press the **Menu** button three times to go back to the main menu.
11. Take a physical sample for lab analysis.

---

### NOTE!

The same lab sample can be used to configure brightness, ERIC, lightness, redness, and yellowness measurements.

---

12. View **A.out 2** and read the measured value. Example: 1200 ppm
13. Calculate the difference between the lab value and the measured value. In the example here the lab value was 300 ppm with an offset of 1000. The offset is then calculated as  $1300 - 1200 = 100$  ppm.
14. Press the **Offset** button.
15. Enter the calculated offset value. Example: 100.
16. Press the **Enter/Menu** button.
17. Press the **Send data** button and then the **Send change** button.
18. Enter the code **42600** and press the **Enter/Menu** button (only needed if send code is ON).

### 4.4.3 Configure Lightness Measurement (L\*)

#### Prerequisites:

- BT-5400 has been mounted and in contact with the process for at least three hours and has the same temperature as the process.
- Reference calibration and reference check have been performed.

#### NOTE!

To demonstrate lightness configuration, hypothetical lab samples are used with a lab value of 70.

1. From the main menu, press **Configure** button.
2. Enter code **5400** and press **Enter/Menu** button.
3. Press **Config.setup** button.
4. Choose an analog out signal. In this example **A.out 3** is used.
5. Toggle the **A.out 3** button until **MIX** is selected.
6. Toggle the **Unit** button until no values are selected.
7. Enter the following values:

Mix BLUE	1
Mix RED	0
Mix GREEN	0
Mix N.IR	0
Mix F.IR/UV	0

8. Press the **Send page** button and then the **Send change** button .
9. Enter the code **42600** and press the **Enter/Menu** button (only needed if send code is ON).
10. Press the **Menu** button three times to go back to the main menu.
11. Take a physical sample for lab analysis.

#### NOTE!

The same lab sample can be used to configure brightness, ERIC, lightness, redness, and yellowness measurements.

12. View **A.out 3** and read the measured value. Example: 10
13. Calculate the difference between the lab value and the measured value.  
In the used example the lab value was 70.  
Then the offset is calculated as  $70 - 10 = 60$ .
14. Press the **Offset** button.
15. Enter the calculated offset value. In the used example 60.
16. Press the **Enter/Menu** button.
17. Press the **Send data** button and then the **Send change** button.
18. Enter the code **42600** and press the **Enter/Menu** button (only needed if send code is ON).

---

#### 4.4.4 Configure Redness Measurement (a\*)

**Prerequisites:**

- BT-5400 has been mounted and in contact with the process for at least three hours and has the same temperature as the process.
- Reference calibration and reference check have been performed.

**NOTE!**

To demonstrate redness configuration, hypothetical lab samples are used with a lab value of -0.5.

---

1. From the main menu, press **Configure** button.
2. Enter code **5400** and press **Enter/Menu** button.
3. Press **Config.setup** button.
4. Choose an analog out signal. In this example **A.out 4** is used.
5. Toggle the **A.out 4** button until **MIX** is selected.
6. Toggle the **Unit** button until no values are selected.
7. Enter the following values:

Mix BLUE	1
Mix RED	-1
Mix GREEN	0
Mix N.IR	0
Mix F.IR/UV	0

8. Press the **Send page** button and then the **Send change** button.
9. Enter the code **42600** and press the **Enter/Menu** button (only needed if send code is ON).
10. Press the **Menu** button three times to go back to the main menu.
11. Take a physical sample for lab analysis.

**NOTE!**

The same lab sample can be used to configure brightness, ERIC, lightness, redness, and yellowness measurements.

---

12. View **A.out 4** and read the measured value. Example: 0.0
13. Calculate the difference between the lab value and the measured value. In the example here the lab value was -0.5. The offset is thus calculated as  $-0.5 - 0 = -0.5$ .
14. Press the **Offset** button.
15. Enter the calculated offset value. In the used example -0.5.
16. Press the **Enter/Menu** button.
17. Press the **Send data** button and then the **Send change** button.
18. Enter the code **42600** and press the **Enter/Menu** button (only needed if send code is ON).

## 4.4.5 Configure Yellowness Measurement (b\*)

### Prerequisites:

- BT-5400 has been mounted and in contact with the process for at least three hours and has the same temperature as the process.
- Reference calibration and reference check have been performed.

### NOTE!

To demonstrate yellowness configuration, hypothetical lab samples are used with a lab value of 7.0.

1. From the main menu, press **Configure** button.
2. Enter code **5400** and press **Enter/Menu** button.
3. Press **Config.setup** button.
4. Choose an analog out signal. In this example **A.out 5** is used.
5. Toggle the **A.out 5** button until **MIX** is selected.
6. Toggle the **Unit** button until no values are selected.
7. Enter the following values:

Mix BLUE	1
Mix RED	0
Mix GREEN	-1
Mix N.IR	0
Mix F.IR/UV	0

8. Press the **Send page** button and then the **Send change** button.
9. Enter the code **42600** and press the **Enter/Menu** button (only needed if send code is ON).
10. Press the **Menu** button three times to go back to the main menu.
11. Take a physical sample for lab analysis.

### NOTE!

The same lab sample can be used to configure brightness, Eric, lightness, redness, and yellowness measurements.

12. View **A.out 5** and read the measured value. Example: 0.0
13. Calculate the difference between the lab value and the measured value. In the example here the lab value was -0.5. The offset is thus calculated as  $7.0 - 0 = 7.0$ .
14. Press the **Offset** button.
15. Enter the calculated offset value. Example: 7.0.
16. Press the **Enter/Menu** button.
17. Press the **Send data** button and then the **Send change** button.
18. Enter the code **42600** and press the **Enter/Menu** button (only needed if send code is ON).



## 4.4.6 Configure UV Measurement

### Prerequisites:

- BT-5400 has been mounted and in contact with the process for at least three hours and has the same temperature as the process.
- Reference calibration and reference check have been performed.

---

### NOTE!

To demonstrate UV measurement configuration, hypothetical lab samples are used with a lab value of 8 % ISO.

---

1. Take a physical sample for lab analysis.
2. From the SPC-1000 main menu, press **A.out** until **5** is selected.  
A value of 9.5 % ISO is presumed.
3. Calculate the difference between the lab value and the measured value.  
In the example here the lab value was 8.  
The offset is thus calculated as  $8 - 9.5 = -1.5$ .
4. Press the **Offset** button.
5. Enter the calculated offset value. Example: -1.5.
6. Press the **Enter/Menu** button.
7. Press the **Send data** button and then the **Send change** button.
8. Enter the code **42600** and press the **Enter/Menu** button (only needed if send code is ON).

## 4.5 Operation

### 4.5.1 Enter Main Menu

1. Switch on SPC-1000.
2. Press **BT-5400** (version 1.0 or higher).

It is recommended to turn off the communication between the JCT-1100 and the BT-5400. Analog out 4 and 5 will be disabled to ensure trouble free communication between SPC-1000 and the BT-5400.

### 4.5.2 Read Data from BT-5400 to SPC-1000

1. **Read data** flashes in the main menu to indicate that data in the SPC does not correspond with data in the instrument.
2. Press **Read data** button.
3. Press **Yes** button.
4. Communication between the SPC-1000 and the instrument is now established and can take approx. 3-4 min. to complete (shown by a progress bar). If communication with the instrument doesn't work - see SPC-1000 error message or troubleshooting.

### 4.5.3 Configure Tag

1. Press **Configure** button.
2. Enter code **5400** and press **Enter/Menu** button.
3. Press **Tag**.
4. Enter tag number, for example **35AI345**.  
Press **3**, wait two seconds and the cursor will jump to the next position.  
Press **5**. Press **1ABC** twice for letter **A**, this must be done within two sec.  
Continue entering the tag number and press **Enter/Menu** once again when completed.
5. Select **Config. setup** button. (**Send page** button flashes if the tag number is altered.)
6. Press **Send page** button.
7. Press **Send change** button.
8. Enter code **42600** and press **Enter/Menu** button (only needed if send code is ON). Communication between the hand terminal and the instrument is established and the latest changes have been sent.

### 4.5.4 View Analog Output Signals

1. Press **Menu** button to enter the main menu.
2. In the large square to the right you see **A.out 1**.  
By pressing the square you can scroll between analog output signals 1 to 5.

## 4.5.5 Take Samples

### 4.5.5.1 JCT-1100

**Prerequisites:**

- BT-5400 has been mounted and in contact with the process for at least three hours and has the same temperature as the process.
  - Reference calibration and reference check have been performed.
1. Press the **Sample** button on the JCT-1100.  
The sampling process starts. Default value are five samples.
  2. While the sampling process is ongoing, take a physical sample for lab analysis.
  3. When the sampling process is finished the display will show **SAMPLE SAVED**.
  4. Press **Enter** button to show the date. Note the date.
  5. Press **Enter** button again to show the time. Note the time also
  6. Press **Enter** or any other button at this stage will finish the sampling procedure.
  7. Save the sample (0-100). Press **Enter**.
  8. To use the saved samples for calibration, the PC-software BT-Calibration is available from BTG.

### 4.5.5.2 SPC-1000

**Prerequisites:**

- BT-5400 has been mounted and in contact with the process for at least three hours and has the same temperature as the process.
  - Reference calibration and reference check have been performed.
  - On the JCT-1100 communication must be **OFF**.
1. From the BT-5400 main menu on the SPC-1000 press the **Calibr.** button.
  2. Enter code **5400** and press **Enter/Menu** button.
  3. Press **Take sample** button.
  4. Select the number of samples by pressing **Avrg. of** repeatedly.
  5. Press **Take sample**. Collect a pulp sample from the line for lab evaluation at the same time.
  6. If the sample is OK, press **Accept**. (If not OK, press **Discard** and take a new sample). The value is now stored in the BT-5400.
  7. Repeat steps above until the desired number of samples has been taken.
  8. When finished, press **Menu** twice to return to the BT-5400 main menu.

### 4.5.6 Check Events Log

1. Press **Misc.** button.
2. Press **Alarm & diagnostics** button.
3. Enter code **5400** and press **Enter/Menu** button.
4. Press **Show log** button.  
Here you will find the latest 40 alarms or events stored.
5. Press **Prev** to scroll backwards in the list.

### 4.5.7 Check Range Selection on the JCT-1100

---

**NOTE!**

Mode = Range

---

1. Check that the transmitter cable inside the JCT-1100 box is connected to J1 (*Range*-inputs).
2. On the JCT-1100 communication must be **ON**.
3. Short-circuit the JCT-1100 between Gnd and Range A(C), the *Range* in the main menu on SPC-1000 will change from "1" to "2".

### 4.5.8 Check Range Selection on the SPC-1000

1. Check that the the white eight-pole connector on the circuit board inside the BT-5400 is connected to Alarm.
2. Press **Configure** button in the main menu.
3. Enter code **5400** and press **Enter/Menu** button.
4. Press **Config setup** button.
5. The **Mode** button should show **Alarm**.
6. Press **Range** button and select 1.
7. Press **Send page** button.
8. Press **Send change** button.
9. Enter code **42600** and press **Enter/Menu** button (only needed if send code is ON).

### 4.5.9 Measuring range and edit range

The BT-5400 (as most of BTG instruments) use the range concept to select different calibration setups to distinguish between pulp types and qualities.

As described in section 4.2.3: *Select Range or Alarm Function*, the selection of measuring range can be controlled from the process via external range selector inputs or set manually by SPC-1000 setting.

This function should not be confused with the SPC-1000 **Edit range**, which is simply a selection of which of the four available ranges to edit. This means, **Edit range** does not select the measuring range of the BT-5400, it gives access to settings and viewing of measurement results for the different ranges.

The selection of which range (calibration) to use for measurement is done by external range selector inputs or via SPC-1000 Config setup selection (see section 4.2.3: *Select Range or Alarm Function*).

## 4.6 Calibration by Sampling

For tuning of the calibration it is recommended that process samples are taken covering the intended span of operation, with respect to the brightness parameters of interest.

Depending on application this may be one or more of the following three:

1. Brightness according to laboratory standard with UV-filter, that is without the fluorescence component.
2. Brightness according to laboratory standard without UV-filter, that is including the fluorescence component.
3. The difference between 1 and 2, that is the fluorescence component only. If more than one of them are to be used, then they should be varied independently in order to achieve a robust calibration. It is recommended that BT-Calibration is used since more than one channel normally is required for calibration.

In BT-Calibration the channels to be included in the calibration procedure can be set, provided that manual calibration mode is used. For all parameters without influence of fluorescence, such as brightness according to the laboratory method with UV-filter,  $L^*a^*b^*$  and ERIC, the UV-channel should be de-activated in order to avoid overfitting. Subsequently, for calibrating parameters with influence of fluorescence, such as brightness according to the laboratory method without UV-filter, or the fluorescence component itself, the UV-channel naturally must be activated. Furthermore, for calibrating the brightness according to the laboratory method without UV-filter, in addition to the UV-channel also at least one of the RGB LED's must be activated, presumably the blue one.

## 4.6.1 General Remarks on Sampling

### NOTE!

The only way to calibrate the transmitter correctly is to take correct laboratory samples and adjust the transmitter accordingly.

To ensure acceptable precision in laboratory samples, *we recommend usage of BTG sampling valves.*

### Sampling procedure:

1. Install the sampling valve close to the transmitter on the same side of the pipe. The valve should be installed so there is no interference from pipe bends, pumps, etc. Recommendations regarding turbulence damping zones are the same as for the transmitter itself.
2. Take a number of samples that cover your entire brightness span. Calculate the mean value and reject samples that deviate widely from the mean. Take an adequate volume for sampling – at least 500 ml (1/2 US quart) for a reliable sample.
3. Make sure that samples for calibration and subsequent checking are **always taken in the same manner** regardless of who does the sampling. Similarly, the **laboratory procedure** must always be exactly the same.

The design of, and compliance with, sampling routines is crucial in assuring uniform treatment of samples. Calibration and future precision of measurement by the transmitter depends on this.

During calibration, the pulp flow past the Transmitter must be *representative* for the position in which it is installed.

## 4.6.2 Take Samples

- On the JCT-1100 communication must be **OFF**.
1. From the BT-5400 main menu on the SPC-1000 press the **Calibr.** button.
  2. Enter code **5400** and press **Enter/Menu** button.
  3. Press **Take sample** button.
  4. Select the number of samples by pressing **Avrg. of** repeatedly.
  5. Press **Take sample**. Collect a pulp sample from the line for lab evaluation at the same time.
  6. If the sample is OK, press **Accept**. (If not OK, press **Discard** and take a new sample). The value is now stored in the BT-5400.
  7. Repeat steps above until the desired number of samples has been taken.
  8. When finished, press **Menu** twice to return to the BT-5400 main menu.

## 4.6.3 View Reference Values

1. Enter the SPC-1000 main menu. See start-up.
2. Press **Ref. Check** button.
3. View all reference values.

#### 4.6.4 Update Reference Values

This section describes the procedure to check whether internal reference values are valid or not.

Over time, changes in the measurement accuracy can occur due to ageing etc. Measured values must not differ more than 0.5 % ISO from the latest values noted in the Reference measurement section of the test report.

For update of reference values see section 4.3.1: *Calibrate using Reference*.

---

**NOTE!**

It is important to note the new values in the Reference measurement section of the test report for the BT-5400.

---



**Caution!**

**A too long damping time constant will reduce the accuracy of the control system .**

## 4.7 Damping and Measuring Span

The damping time constant is set after calibration has been completed. Set it so that the signal is stable. Use a mean value of 0-40 measurements, allowing 6 seconds for each measurement.

If a very long time constant is needed due to an unsteady probe signal, the transmitter is probably working in an unstable, poorly mixed pulp flow. In this case you should consider:

- Relocating the transmitter further from the pump.
- Improving the remixing system or the supply of dilution water, etc.

Setting a too long time constant reduces the benefit of the transmitter's high precision. Contact BTG for further advice.

### 4.7.1 Set Damping

1. From the BT-5400 main menu on the SPC-1000 press the **Trend** button. Study the stability of the signal.
2. Press the **Menu** button and select **A.out** for the desired channel.
3. Press the **Damp** button and enter a suitable mean value, for example 5.
4. Press **Send data** followed by **Send change**.
5. Enter code **42600** and press **Enter/Menu** button.
6. Press **Trend** and study the result.
7. If necessary, adjust the damping.

### 4.7.2 Set Measuring Span

Try to keep the measuring span as narrow as possible.

1. Select **A.out** for the desired channel.
2. Set the brightness level for the lower limit of the measuring span. Press **4 mA** for the lower limit (4 mA).
3. Enter the new value and press **Enter/Menu**.
4. Press **20 mA** for the upper limit (20 mA).
5. Enter the new value and press **Enter/Menu**.
6. Check that the settings are correct.
7. Press **Send data** followed by **Send change** to transfer the values to the transmitter.
8. Enter code **42600** and press **Enter/Menu** button (only needed if send code is ON).

## 4.8 Compensation

To compensate for consistency the BT-5400:s analog input can be used by connecting the signal from an external consistency transmitter.

To get a consistency span, it is best to perform a process dilution for approx. 10 minutes and during the process read the signal from both the brightness transmitter and the consistency transmitter. Samples should be taken during and after dilution.

### 4.8.1 Adjust mA Input Signal

1. Connect the mA-source "+" to JCT-1100 terminal AUX In+ (F) via a DMM (digital multimeter) set on current metering to 20 mA (smallest possible range) and "-" to terminal ground (GND).
2. From the SPC-1000 main menu, press **Misc** button.
3. Press **Factory setting** button.
4. Enter code **1632** and press **Enter/Menu** button.
5. Press **A.in** button.
6. Apply 4.0 mA input current. Read the value.
7. Press **Set 4 mA** button.
8. Enter the value and press **Enter/Menu** button.
9. Apply 20.0 mA input current. Read the value.
10. Press **Set 20 mA** button.
11. Enter the value and press **Enter/Menu** button.
12. Press **Send** button
13. Press **Send change** button to transfer the values to the transmitter.
14. Enter code **42600** and press **Enter/Menu** button (only needed if send code is ON).
15. Press **Menu** three times to enter the main menu.

## 4.8.2 Collect Compensation Values

This procedure is divided into two phases.

The first phase is to collect physical samples from the pulp line and at the same time note the values **A.out-process-eu** for output signal value and the **A.inp-EU** for the compensation signal.

The second phase is to use collected and noted values to activate compensation.

For example:

### PHASE 1:

1. Take physical lab samples from the pulp line.
2. On the SPC-1000 press **Misc** button.
3. Press **Factory setting** button.
4. Enter code **1632** and press **Enter/Menu** button.
5. Press **All signals** button.
6. Press **A.out** button to scroll between the output signals (**OUT.1**).  
Select the output signal that to be compensated.
7. Note the **A.out-process-eu** for output signal value and the **A.inp-EU** for the compensation signal.

### PHASE 2:

1. Press **Menu** button three times to enter the main menu.
2. Press **Configure** button.
3. Enter code **5400** and press **Enter/Menu** button.
4. Press **Comp A.out (1-5)** button.
5. Select **A.out (1-5)**.
6. Press **Select comp.** button to scroll to **A.IN** if that signal is to be used for compensation.
7. Press **Set comp. table** button.
8. Press **Edit sample** button to scroll to line 1. Line 1 can, for example, be low consistency (low analog input signal), line 2 can be the nominal value (operating point) and line 3 high consistency (high analog input signal).
9. Press **Load EU value** button to enter the analog output signal value noted from step 7 in phase 1 and press **Enter/Menu** button.
10. Press **Load comp. fact** button to enter the required compensation in percent noted from step 7 in phase 1 and press **Enter/Menu** button.
11. Press **ON/OFF** button to activate the compensation factor **ACT=ON**.
12. Proceed in the same manner for all the rows.
13. Press **Menu** button.
14. Press **Send page** button.
15. Press **Send change** button to transfer the values to the transmitter.
16. Enter code **42600** and press **Enter/Menu** button (only needed if send code is ON).
17. Press **Menu** twice to enter the main menu.



## 5 Service Instructions

In section 5.1 you will find a summary of maintenance that must be carried out and the maintenance intervals. In section 5.2 to section 5.7 you will find the instructions for performing the maintenance.

### 5.1 Continuous Maintenance

#### 5.1.1 Calibration Period (approx. 1 month)

- Check against reference once weekly.

#### 5.1.2 Guarantee Period (approx. 6 months)

- Check against reference once monthly.

#### 5.1.3 Daily Checks

- Check the output signal.
- The output signal from the transmitter must not deviate from lab samples. How often a lab sample should be taken depends on positioning and requirement. Determine the tolerance level.

#### 5.1.4 Weekly Checks

- Ensure that the transmitter is in position. Check for leaks.

#### 5.1.5 Monthly Checks

- Trend follow up against lab samples. Determine the tolerance level.
- Make a note of internal signals.

#### 5.1.6 Semi-annual Checks

- Check the transmitter with the reference to ensure ISO-values are still valid. If not, update reference values, see section 4.3.2: *Check Reference Calibration*.
- Check the ball valve and its O-rings for leakage.
- Clean the window and lubricate the probe tube.
- Check the box for moisture.

### **5.1.7 Annual Checks**

- Check the ball valve
- Check the mounting stud
- Clean the exterior of the transmitter.

### **5.1.8 Bi-annual Checks**

- Replace any leaking sealings
- Check the reference against lab values. Update values.

## 5.2 Alarm and Events

The system has an Eventlog, which is accessible from the SPC-1000. Alarms and exceptions should be recorded in the log.

All alarms start with \* in the Eventlog to avoid being confused with Exceptions.

### 5.2.1 Alarms

The following alarms can be set by the user:

Analog out 1, Analog out 2, Analog out 3, Analog out 4, Analog out 5, Analog inp.

In SPC-1000 programming the following abbreviations are used:

"Aout1", "Aout2", "Aout3", "Aout4", "Aout5", "Inp"

Four different alarm conditions are reported in the Eventlog:

"Hi", "Lo", "OK", "Off"

"Hi" and "Lo" refer to the limits, High and Low, which can be set for the alarms. When these are passed, a text stating the alarm is shown in the Eventlog and whether the upper or lower limit is exceeded (Hi or Lo). The actual value at the time of the alarm is also shown.

Example:

Aout 1 has exceeded its upper alarm limit of 74.0:

Appearance in SPC

Date:	2007-03-16 11.12.02
Event:	*Aout1 Hi
Value:	75.2
Range:	1

When the value is back within the alarm limits, it is logged with the addition OK.

Example:

The Aout 1 value is below the alarm limit 74.0.

Appearance in SPC

Date:	2007-03-16 11.32.12
Event:	*Aout1 OK
Value:	70.4
Range:	1

An active alarm that is shut off is marked in the log by "Off".

If the alarm output is activated by one or several alarms, all active alarms must be deactivated before the alarm output is deactivated. Set the alarms to OFF to do this.

This event will be logged with "Car alarm".

## 5.2.2 Exceptions

Exceptions are reported to be used for diagnosis or troubleshooting, mainly by BTG personnel.

Why and when Exceptions are reported can not be influenced by the user.

**The following things may cause an Exception:**

Event	Description Text	Description
System start	"Started.	"When the system is restarted after a power-fail. (voltage drop)
New program version	"New progr.	"All settings are reset to basic settings when a new program is downloaded to the transmitter (same or new version).
Cleared Eventlog	"Clr.EvLog	"From the table Device column ClearEvents all items in the Eventlog can be cleared.
Changed settings	"New config	"Changes made from SPC-1000 generate an exception. At certain occasions additional information will occur (see below).
Overflow	"Pre.T err	"T-DETECTOR: Cannot increase amplification further. Preamplification max= 32.
Underflow	"Pre.T err	"T-DETECTOR: Cannot reduce amplification further. Preamplification min= 1.
OK	"Pre.T OK	"T-DETECTOR: Within the control range again.
Overflow	"Pre.M err	"M-DETECTOR: Cannot increase amplification further. Preamplification max= 32.
Underflow	"Pre.M err	"M-DETECTOR: Cannot reduce amplification further. Preamplification min= 1.
OK	"Pre.M OK	"M-DETECTOR: Within the control range again.
zero division	"K1=0	"Calibration: The constant is zero.
zero division	"K1 is OK	"Calibration: Constant OK.
zero division	"K2=0	"Compensation: The constant is zero.
zero division	"K2 is OK	"Compensation: Constant OK.

Additional information may occur in the Value field for some events:

- When a new program version ("New progr.") is loaded, it is shown here.
- Alarm
- Preamp

Otherwise the value is 0.00.



### 5.2.3 SPC-1000 Error Messages

The SPC communicates with the transmitter using HART® protocol. The SPC-1000 and the transmitter has a Master-Slave relationship where the SPC-1000 is Master (secondary master) and the transmitter is Slave.

The error messages that occur on the SPC-1000 always starts with Cmd\*, where \* represents the command which led to the error.

**The following error messages can occur:**

Error message	Description	Action
Comm line busy	The line is busy by another Master. The SPC-1000 will try to find an opening in the line 5 times.	The other Master does not follow the HART standard. Disconnect or turn the other Master off.
Not from slave	The answer comes from another Master and not from the transmitter.	Disconnect the HART unit which is not the one that you want to communicate with since there are terminals that do not function properly.
Comm error	Communication error / parity error.	Can be due to disturbances in the environment or bad cables. Check all cables and fittings.
Wrong slave ID	The answer comes from another Slave than the SPC-1000 sent the command to.	Normally there is only one Slave and the error will not occur. Disconnect any Slave other than the one you want to communicate with.
Wrong reply cmd	Wrong answer to the command. The transmitter has given answer to a question the SPC-1000 did not send.	Probably there are other units connected to the cable that disturb the communication. Disconnect them.
Cmd resp error	A protocol error between the SPC-1000 and the transmitter. The transmitter does not understand the SPC-1000 properly.	Update the software in the SPC-1000 or the transmitter so that they can communicate.
Data length err	The command is too short.	Update the software in the SPC-1000 or the transmitter so that they can communicate.
Invalid message	Error in the message part as for checksum (below).	Check the cables between the transmitter and the SPC-1000.
Invalid chksum	Wrong checksum on package (results normally in re sending).	Check the cables between the transmitter and the SPC-1000.
Reply time out	The instrument do not respond to command (Waiting time 256 ms).	The SPC-1000 is not connected to the transmitter or the transmitter is not turned on. Check the cables between the SPC-1000 and the transmitter.
HART rev error	Wrong version of the HART protocol. It should be version 5.	Update the software in the SPC-1000 or the transmitter so that they can communicate.
Not BT-5400 dev	Wrong transmitter to what is chosen in the SPC.	Choose the right transmitter when starting the SPC-1000.
BT-5400 rev err	Right transmitter but incompatible version of the protocol.	Update the software in the SPC-1000 or the transmitter so that they can communicate.
Dev change/repl	The SPC-1000 is connected to another transmitter than where the data comes from. It is identified by the serial number.	Connect to the right transmitter and start with <b>READ DATA</b> . If it is the right transmitter go to <b>READ DATA</b> .

## 5.3 Sampling, Sheet Determination, Brightness Determination and Instrument Follow-up

Sampling to determine brightness and the subsequent laboratory analysis provides a reference for calibration and follow-up of the transmitter. It is therefore most important that both sampling and laboratory analysis prioritize accuracy and repeatability. The transmitter's accuracy and repeatability is based on these criteria:

- **Sampling.** The sampling equipment and its positioning determine whether or not a representative sample can be extracted from the pipe. The sampling technique is necessary to transfer the sample to a safe vessel. A sample taken from a completely different position, such as a wash filter, at an uncertain time, will provide a less reliable result than a sample extracted close to the transmitter while measuring signals were noted. Some important aspects to consider are: the variations in samplers (ball valve vs mushroom valves), transmitter filtering time, sample accuracy, process variations and process parameters for personal safety (burns can occur at temperatures over 50°C / 122°F, dangerous or acid chemicals, process pressure).
- **Sheet determination** according to SCAN CM 11:95 (=ISO 3688).
- **Determination of brightness** according to SCAN P 3:93 (=ISO 2470, =T525 On-92).
- **Determination of fluorescence** in Anex B (=ISO 2470, =T525 On-92).
- **Follow-up.** It is advisable to follow up the transmitter using [Error = Lab.sample - Transmitter] as a follow-up. It is also worth setting a suitable tolerance level at which actions must be taken. See document SSG 5252. Another important follow-up procedure is to check transmitter measurements against references and to check the references.

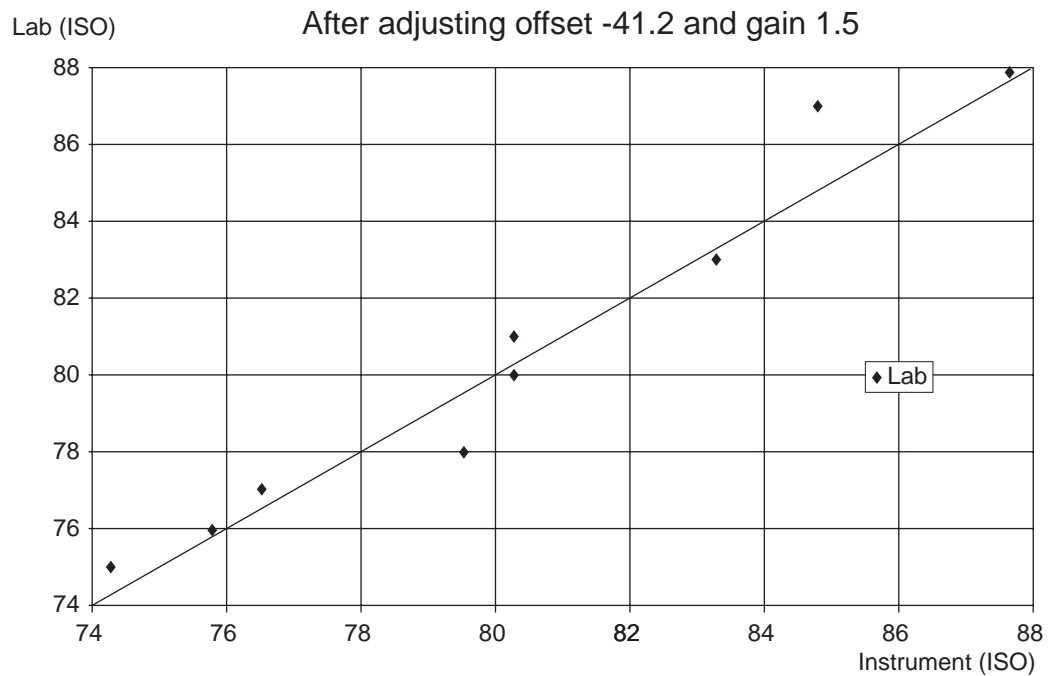
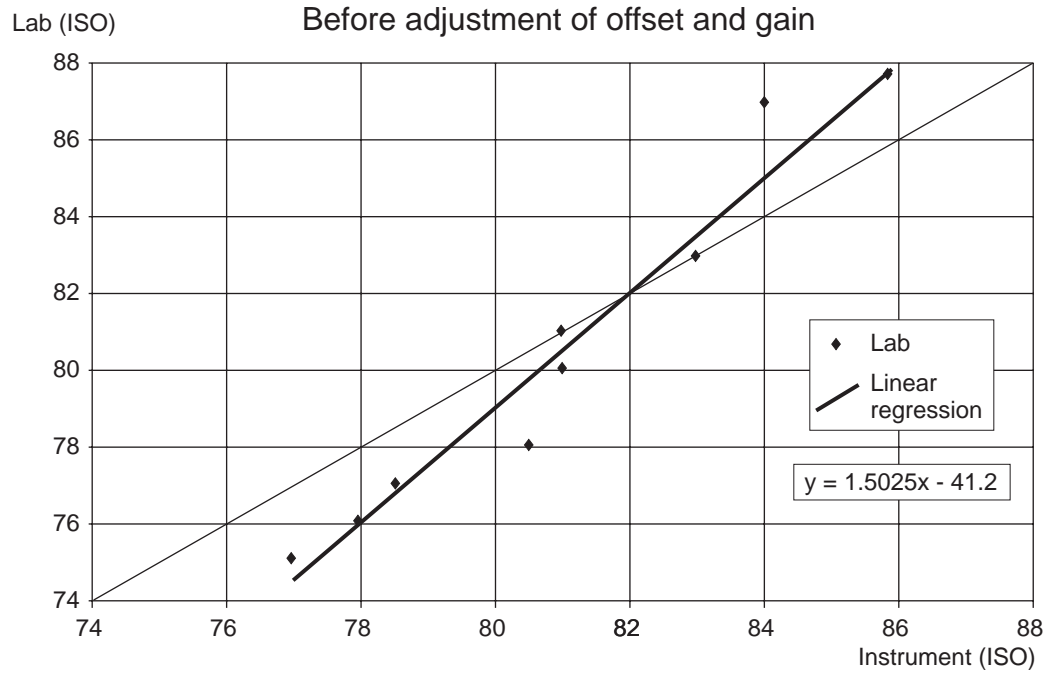
### NOTE!

BTG is not allowed to publish the SSG or SCAN standards but they are available from SCAN (Scandinavian Pulp, paper and board) and SSG (Pulp and paper industries engineering Co.).

- **Adjust offset and gain.** Re-calibration or adjustment of offset (zero point adjustment) and gain (amplification) may be required after some time. Example: Before adjustment: offset = 0, gain = 1 and standard deviation=2. After adjustment: offset = -41.2, gain = 1.5 and standard deviation=1.
- **Mixing.** When you have sufficient number of sample values you can make a linear multiple regression. Use a specific program or MS Excel and the following formula:

EXAMPLE:

MIX(ISO)= Offset+Gain\*[mixfactor\*Proc.Eu(Blue) + mixfactor\*ProcEu(Green)]



## 5.4 Mechanical Maintenance

### Material:

Screw driver  
Universal screw wrench  
Flash light  
Lubricant for sealings

### 5.4.1 Remove Moisture from Circuit Board

1. Loosen the cover.
2. Check the gasket to make sure that no liquid can penetrate.
3. Carefully lift the cover.
4. Use a lamp to check for any condensation on the circuit board.
5. Check that LED 3 is lit and that LED 4 flashes once every five seconds.

### 5.4.2 Retract Transmitter from Sluice Valve

1. Use protective goggles and chemical-resistant equipment. Inform the operator what you are doing.
2. Turn off the transmitter at JCT-1100.
3. Disconnect the cable connections.
4. Loosen the two safety screws behind the box.
5. Screw out the transmitter.
6. Close the valve.
7. Loosen the locking nut on the trapezoid threaded screw.
8. Screw out the transmitter.

### 5.4.3 Check Window

1. The transmitter must be removed.
2. Wipe the window with a cotton cloth.
3. Illuminate with a lamp.
4. Check that the window is intact and also check it for scratches.
5. Check that there is no dirt on or underneath the window.
6. Check that there is no condensate under the window.

#### **5.4.4 Clean Probe and Window, SPC-1000 and References**

1. The transmitter must be removed.
2. Wipe the window with a cotton cloth.
3. Use alcohol on the pipe and window. For a more stubborn coating of resin you might need to use diluted 3M hydrochloric acid.  
Dry off with a cotton cloth.
4. Grease the metal surface of the pipe.
5. Clean the SPC-1000 according to section 5.4.5.
6. Clean the references with a small amount of washing detergent and water. Put them in a microwave oven to dry for one minute. Leave in a exicator for 10 minutes. Let rest at room temperature for 30 minutes before making a measurement in the brightness transmitter.

#### **5.4.5 Clean SPC-1000**

The terminal can be cleaned using a cotton cloth dipped in water.  
Avoid water getting into the edges of the covers.

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**NOTE!**

Use only mild cleaners. Clean and dry with care!

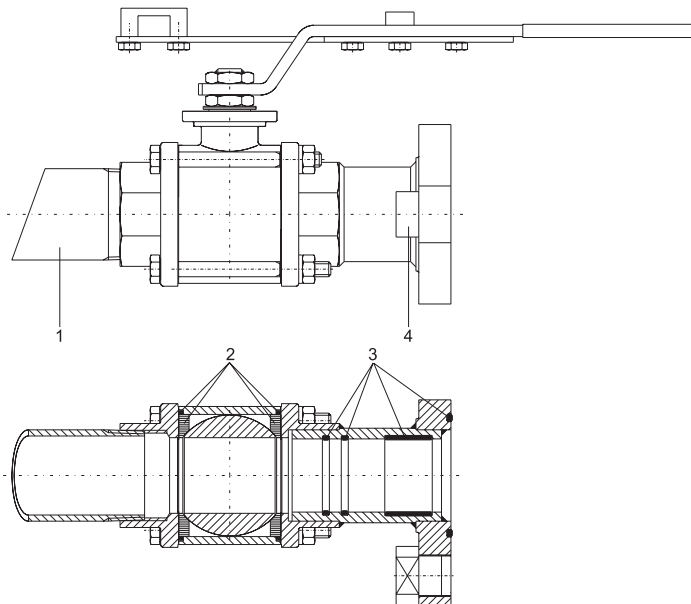
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## 5.4.6 Replace Sluice Valve Seals

1. The process must be shut down and the pipe must be empty.
2. Make the replacement according to the figure.
3. Grease the sealings after the replacement.

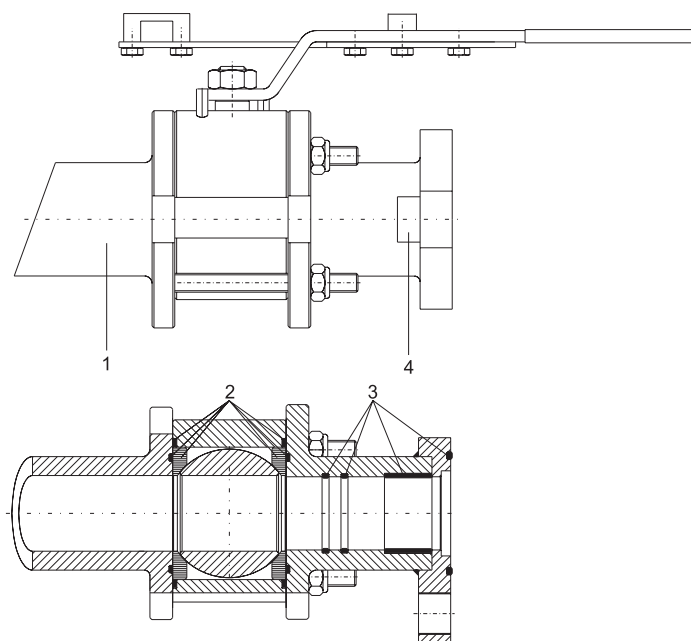
**Fig 5 Ball valve with weld-in stud in stainless steel**

- 1 Weld-in stud
- 2 Sealings
- 3 Sealings
- 4 Trapezoid nut



**Fig 6 Ball valve with weld-in stud in titanium**

- 1 Weld-in stud
- 2 Sealings
- 3 Sealings
- 4 Trapezoid nut



### **5.4.7 Insert Transmitter**

1. Grease the sealings and the tip of the probe tube. Do not grease the optical surface and the trapezoid threaded nut.
2. Do not forget the O-ring on the flange.
3. Insert with a continuous twisting motion until the probe touches the stop.
4. Fasten the nut on the trapezoid threaded screw.
5. Open the valve.
6. Crank the handle until the O-ring positions correctly. The flange on the probe will meet the flange on the ball valve.
7. Lock the transmitter with two locking screws.
8. Connect the cables.
9. Switch on power to JCT-1100.

## 5.5 Service Hardware, I/O part

### Material:

Digital Multimeter (DMM)  
4 to 20 mA meter.  
(Oscilloscope)  
Reference included with delivery  
Screwdriver

### 5.5.1 Electric Test-points

Check that there is power to the instrument and that the fuses in the junction box are intact. Also check that fuse S1 (250 V Slow 2 A) on the circuit board is intact. Check that LED 3 is lit up, indicating that 24 V DC is present.

Measure the following voltages:

GND (TP0) and TP3 :	+24 VDC± 2V
GND (TP0) and TP1 :	+15 VDC± 0.75V
GND (TP0) and TP2 :	+5 VDC± 0.25V
GND (TP0) and TP4 :	-15 VDC± 0.75V
GND (TP0) and TP5 :	-5 VDC± 0.25V
GND (TP0) and TP7 :	+5 VDC± 0.05V
GND (TP0) and TP8 :	+10 VDC± 0.05V
GND (TP0) and TP9 :	+1.235 VDC+ 15mV / -35mV

Check the following if something is wrong::

- **Is the application program running?**

LED 4 indicates if the boot program or an application program is running or not. If it is flashing once per second, the boot program is running and waiting for the application program to be downloaded via an RS-485 cable (for BTG personel only). If it flashes approximately once every 5 seconds, the application program is running. If the LED is constantly on or off, the program has not started.

- **Are all cables connected correctly?**

Check that all cables are properly inserted.



## 5.5.2 Checking Communication to and from SPC-1000

Check that a resistor (250 - 300ohms) is fitted between terminals Out1+(mA1+) and Out1-(mA1-) in JCT-1100.

Connect SPC-1000 to JCT-1100 and switch on the hand terminal. Choose **BT-5400** and the latest version.

### 5.5.2.1 Check Range-inputs

Check that the transmitter cable (to /from JCT-1100) is placed in contact J1 (Range-inputs).

1. Short-circuit JCT-1100 between terminals Gnd and Range A(C), then check that LED 1 is lit up and that **Range** on the main menu of SPC-1000 changes from **1** to **2**. Note that it can take up to 5-10 seconds before the range changes.
2. Short-circuit between terminals Gnd and Range B(D), then check that LED 2 is lit up and that **Range** changes to **3**. Note that it can take up to 5-10 seconds before the range changes.

### 5.5.2.2 Check Alarm-output

1. Turn off JCT-1100 and move the transmitter cable to the circuit board from J1 to J4.
2. Put on the reference on the probe.
3. Switch on JCT-1100 again. Wait until the meter has stabilized (approx. 2 minutes) and make a note of the measured value shown in the lower right hand box on **Range1**.
4. Press **Configure** button.
5. Enter code **5400**, and press **Enter** button.
6. Press **Config setup** button.
7. Press **Mode** button until the text under **Mode** shows **Alarm**.
8. Press **Menu** button until the main menu comes back.
9. Press **Misc** button.
10. Press **Alarm & diagnostic** button.
11. Enter code **5400** and press **Enter** button.
12. Check that the button to the left shows **Set alarm A.out1**. The button second from the far left shall show **Alarm ON**, if not press this button.
13. Press **Low** button and enter the measured value +10 units.
14. Check that **High** is greater than **Low**.
15. To download new limit values to the transmitter, press the (flashing) button **Send page** and then **Send change**.
16. Check (diode meas) between terminals 14 and 15 on JCT-1100 "+" on Range A(C) and "-" on Range B(D). It should be less than 0.1V.
17. Check that LED 5 is lit up when the alarm is activated.
18. Press **Alarm ON** until it shows **Alarm OFF**.
19. Press **Send page** button and **Send change** button and check that LED 5 goes out and that the DMM measures "OL".

20. Switch off the JCT-1100 and move the transmitter cable back to contact J1 (Range-inputs) and change so that **Mode** shows **Range**.

### 5.5.2.3 Check the Temperature Sensor

Remove the transmitter from the process and allow it to cool for 3 hours.

1. From the SPC-1000 main menu select **Misc.**
2. Press **Factory setting** button.
3. Enter code **1632** and press **Enter** button.
4. Select **All signals**.

Wait for 5 seconds before the page is updated. **Mraw temp** (temperature at the probe tip) should be approx. 25°C / 77°F (room temperature) and the **Internal temp** (temperature of the circuit board) approx. 40°C / 104°F. If the transmitter is installed the process, the internal temperature could be up to 20°C / 68°F higher than the ambient temperature. The temperature of the medium should however be less than or equal to the process temperature. Temperature transmission to the temperature sensor can vary, depending on the mounting stud material.

### 5.5.2.4 Check or Calibrate mA Input Signal

1. Connect a mA-source "+" to JCT-1100 terminal AUX In+ (F) via the DMM set on current metering to 20 mA (smallest possible range) and "-" to terminal Gnd.
2. From the SPC-1000 main menu, press **Misc.** button.
3. Press **Factory setting** button.
4. Enter code **1632** and press **Enter** button.
5. Press **A.in** button.
6. Adjust the mA-meter to exactly 20.00 mA. Read the value in **Input (0-1023):**.
7. Press **Set 20 mA**.
8. Enter the value and press **Enter** button.
9. Adjust the mA-meter to obtain 4.00 mA. Read the value in **Input (0-1023):**.
10. Press **Set 4 mA**.
11. Enter the value and press **Enter** button.
12. Press **Send** button.
13. Press **Send change** button to transfer the values to the transmitter.

### 5.5.2.5 Check or Calibrate mA Output Signal

1. Connect the DMM set to mA (the smallest range for 20 mA) in series with the resistor in JCT-1100 on mA-output #1 (terminals **mA1-** and **mA1+**).
2. From the SPC-1000 main menu, press **Misc.** button.
3. Press **Factory setting** button.
4. Enter code **1632** and press **Enter** button.
5. Press **A.out** until **A.out OUT.1**.
6. Press **Test value** button.
7. Enter **20** and press **Enter** button.
8. Press **Send** button.
9. Press **Send change** button.
10. Adjust using the buttons **20 up** or **20 down** and then press **Send** button.
11. Press **Send change** button to obtain the new signal.  
Keep repeating these actions until exactly 20.00 mA is obtained. The test signal **Test value** is active for approx. 15 sec. before the output signal is reset.
12. To calibrate 4 mA, press **Test value** button.
13. Enter **4** and press **Enter** button.
14. Press **Send** button.
15. Press **Send change** button.
16. Adjust with the buttons **4 up** or **4 down** and then press **Send** button.
17. Press **Send change** button to obtain the new signal.  
Keep repeating these actions until exactly 4.00 mA is obtained.
18. Then move the DMM to mA-output #2 (terminals mA2- and mA2+).
19. Press **A.out** until **A.out OUT.2**.
20. Repeat the above procedures and then test output #3, #4, #5 in the same manner.

## 5.6 Testing of Optics

### 5.6.1 Check LEDs and Measuring Cycle

1. Remove the transmitter and turn it so that the probe pipe is pointing upwards.
2. Check to make sure that the LEDs light up one at a time for one second and then emit a flash. During the measuring sequence the LED will be lit up for a second and during a test for 20 milliseconds. A measuring cycle takes about 5 seconds.

The blue LED can light up when it should be switched off due to leaking current. The light however is so weak that it will not affect other LED measurements.

### 5.6.2 Perform Reference Check

1. Press **Ref. Check**.  
Check if all values are valid.

### 5.6.3 Set Optical Part

1. It is important that the probe window and references are kept clean.
2. Put on the reference with the highest ISO value (included with the transmitter) on to the probe-tip. Check that the brightness reference is fixed in position. Put down the transmitter on the box part, with the probe pipe pointing upwards.
3. Wait a while for the transmitter to adjust.
4. In the SPC-1000 main menu, press **Configure** button.
5. Enter code **5400** and press **Enter** button.
6. Press **Config setup** button.
7. Press **LED** button.
8. Select **Config** until **Config T-LED** is visible.
9. Set the **TM.Meas** to  $2800 \pm 100$  and **Preamp.M** to 1 by pressing **LED curr.** and entering a new value. Press **Enter** and then **Send page**.

---

#### NOTE!

The measuring range for XM.meas and XT.meas is from 0 to 4095.

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10. Check that **TM.Dark** and **TT.Dark** are approx.  $300 \pm 10$  units. This tolerance applies when PreAmp readings are lower than 4.
11. Check that  $(\text{TM.Meas} - \text{TM.Dark}) / \text{PreAmp.M}$  is approx. the same as **TM.diff.** and **PreAmp.M**.  
The same applies to  $(\text{TT.Meas} - \text{TT.Dark}) / \text{Preamp.T}$ , this should be approximately equal to **TT.diff.** The value indicated by **Preamp.T** is not an exact value but a more exact value has been entered in the transmitter's software.

12. Press **Config.** to get next color and set **TM.Meas** to a value close to 2800 and set **Preamp.M** to 1 for all colors (blue, green, red) by adjusting the LED current if necessary.  
TT.Meas and Preamp.T should be set for N.IR and F.IR.  
Perform these steps for all colors, N.IR, and F.IR, and perform the checks in step 10 and 11 for all colors, N.IR, and F.IR.

#### 5.6.4 Check of Grounding

1. Start by checking the resistance in the DMM measuring cables.
2. Remove the external grounding cable from the probe.
3. Turn off the power on the JCT-1100.
4. Measure between the probe pipe and the JCT-1100 shielding lacquer. Deduct the resistance of the measuring cables. The resulting resistance shall be less than 5 ohms and normally around 1-2 ohms.

## 5.7 Troubleshooting

Error	Probable cause	Suitable measure
Can't communicate with SPC-1000.	<p>Missing resistor 250 - 300Ω in JCT-1100 terminals mA1+ and mA1-. The resistor is not in series with DCS.</p> <p>Cable between the transmitter and the JCT-1100. The shield must be connected in the PG fitting or in the binder contact.</p> <p>Contacts not tightened.</p> <p>Cables inside the JCT-1100 drawn in small loops.</p> <p>Cable too close to the high-voltage cable.</p> <p>Too much AC signal (more than 50 mVAC) on the shield or the communication cable.</p> <p>Too high AC signal (more than 120 mVAC) on the external 24 VDC supply.</p>	<p>Measure in the JCT-1100 on terminals mA1+ and mA-. The voltage must be more than 1.0 V. Less than 1.0V: wrong resistance. Higher than 18 V: Mount only 249 Ω in terminals mA1+ and mA1-. The voltage must be between 1 and 5 V.</p> <p>Check the grounding.</p> <p>Tighten contacts.</p> <p>Straighten cables.</p> <p>Move power cables.</p> <p>If the AC signal is too high on the shield, mount a 100-220 microF, 16 Volt bipolar capacitor between the shield (on the analog out cable) and terminal mA1+.</p> <p>Mount a 10,000 microF 40 Volt capacitor between the + and the - on the incoming 24 VDC supply.</p>
The SPC-1000 data is not as expected.	The SPC-1000 and instrument are operating in different ranges.	Change edit range (SPC-1000).
Exceptions includes underflows and overflows.	LED current is too high or too low. The LED is faulty. The LED is too weak. The window is broken. There is no pulp in the pipe.	Maintain probe and LED.
Can't communicate over the RS-485 cable.	Faulty electrical connections on A, B or the common contact. Wrong address.	Check connections and troubleshoot RS-485 find address.
The blue signal drops when brightness increases.	Color changes (the liquid turns more yellow) in the process.	Calibrate mix.
Both the blue and the green signal increase and decrease but lab samples are stable.	Consistency variations, compensation needed.	Compensate using analog IN and CS transmitter.
The raw signal fluctuates a lot.	Low flow. High amplification (Preamp). Poorly mixed pulp.	Move the probe to another position.
The dark signal fluctuates a lot.	Poor earthing, check all earthings, shields and contacts against shield lacquer, etc.	Check grounding. Bad 24 VDC. Check capacitor or resistor value from shield to ground.
The raw signal drops significantly 5-10 minutes after the instrument has been inserted in the process.	Moisture on the inside of the window. Fiber optics are not properly fastened.	Clean the probe, make sure that it is dry inside and make sure the fiber optics are fastened.
The raw signal drops in relation to the reference.	Dirt on the window. Dirt or moisture on the inside of the window. Measurements made at different temperature. Fiber optics have loosened. O-ring leakage.	Clean the probe and make a reference procedure. Check the O-rings and the O-ring groove.
The logging program stops or runs slowly.	Too low uptime rate.	Increase the uptime rate from 7 to 10-155.1

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Error	Probable cause	Suitable measure
Leakage from a new ball valve.	The ball valve has been used for taking samples. Wrong sealings. The ball valve is damaged.	Use the ball valve only for inserting the probe. Change sealings. Check the ball valve.

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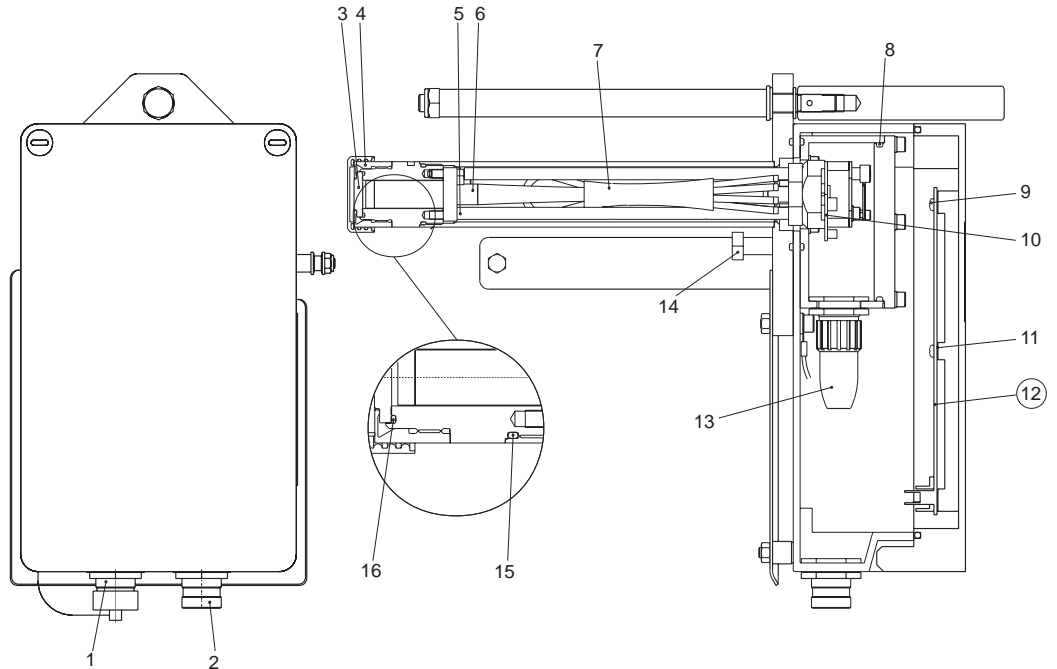


## 6 Parts List

### 6.1 Measuring Probe

**Fig 7 Measuring Probe**

- 1 Contact RS-485
- 2 Contact junction box
- 3 Window Sapphire
- 4 Window socket
- 5 Temperature sensor
- 6 Fiber optics
- 7 Fiber optics
- 8 O-ring 79.5x3 EPDM
- 10 Optics board
- 13 Contact second seal
- 14 Screw M6S 10x25
- 15 O-ring
- 16 O-ring



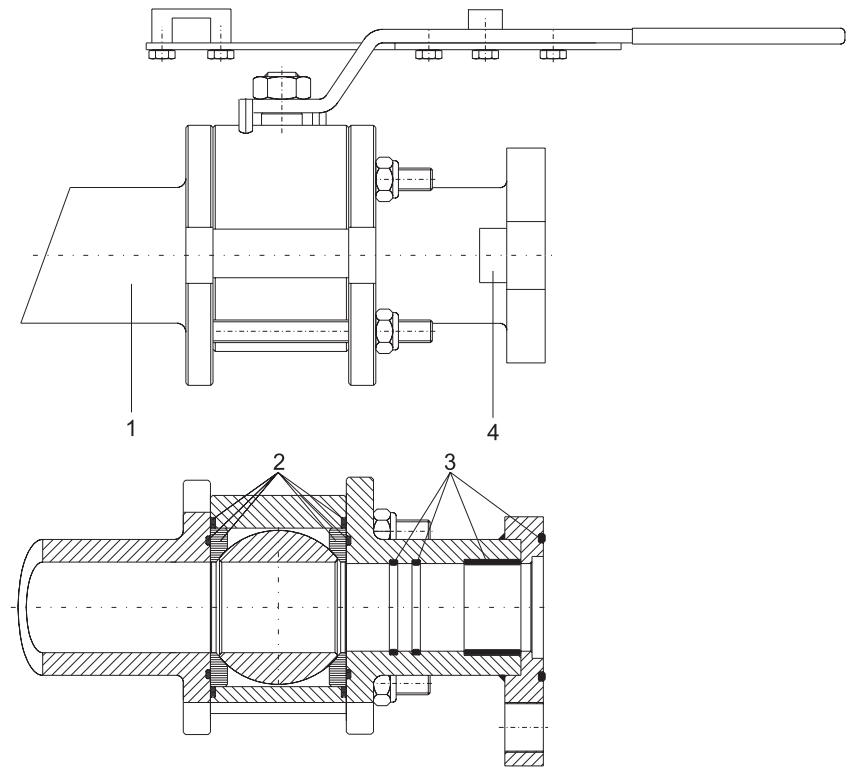
#### Spare Parts

Item No.	Rec. spare parts	Qty	Part No. Stainless steel	Part No. Titanium	Spare part	Description
9	6				Screw	Included in Sensor board kit, item no. 12
11	1				Nylon washer	Included in Sensor board kit, item no. 12
12	1		B0011163	B0011163	Sensor board kit	

## 6.2 Ball Valve

**Fig 8 Ball Valve**

- 1 Weld-in stud Stainless Steel
- 1 Weld-in stud Titanium grade2
- 1 Weld-in stud 254SMO
- 1 Weld-in stud FRP
- 2 Sealing EPDM
- 2 Sealing Zalak
- 4 Nut for trapeze bar



### Spare Parts

Item No.	Rec. spare parts	Qty	Part No. Stainless Steel	Part No. Titanium	Spare part	Description
3	*	1	84514488		Sealing kit	EPDM
3	*	1		84514280	Sealing kit	Zalak

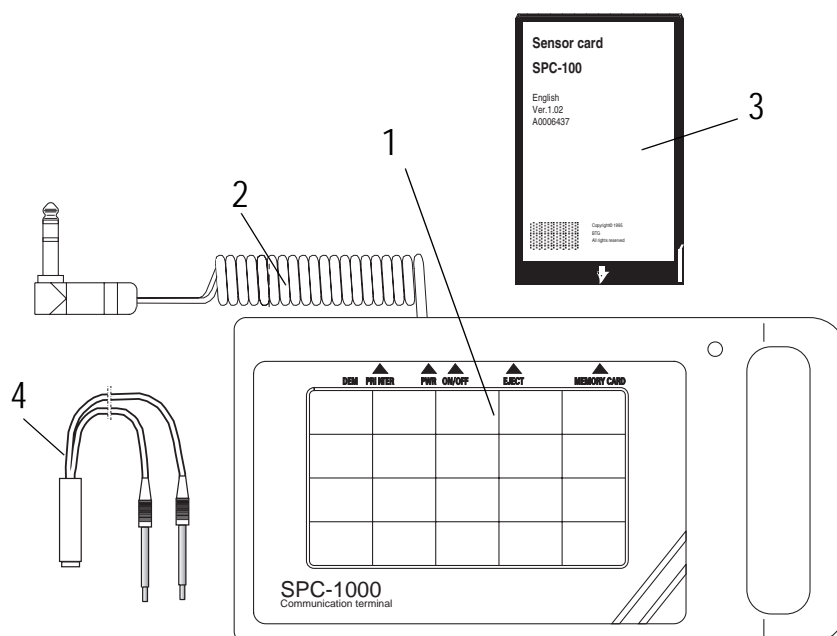
## 6.3 Accessories

### JCT-1100

Item No.	Rec. spare parts	Qty	Part No.	Spare part	Description
		1	A0092155	Analog out extension kit	Analog Out 4 & 5 extension kit for BT-5400.

For more information regarding JCT-1100 parts, see section 8.6.

### Accessories



Item No.	Rec. spare parts	Qty	Part No.	Spare Part	Description
1	*	1	93253847	Hand-held terminal, complete	SPC-1000
2	(*)	1	84396449	Connection cable, complete	
3	(*)	1	74399536	Sensor card	SPC-1000/A
4		1	74417959	Adapter for terminal connection	
		1	46021309	Mains adapter (not shown)	220 VAC / 12 VDC
			46021317		110 VAC / 12 VDC
		1	74417959	Adapter for terminal connection	
	*	1	46019873	Alkaline battery (not shown)	9V 6LR61
		1	A0003632	Reference complete (for UV with fluorescence paper)	
		1	A0003111	RS-485 cable for PC software BT-Calibration	
		1	A0093252	BT-Calibration software	

Notes: Recommended spare parts marked \* have a typical operating life of two years. Recommended spare parts marked (\*) are less likely to be needed but are recommended where many transmitters are in operation.



## 7 Appendix

### 7.1 Planning the Installation

#### 7.1.1 Choosing a Site for the Transmitter

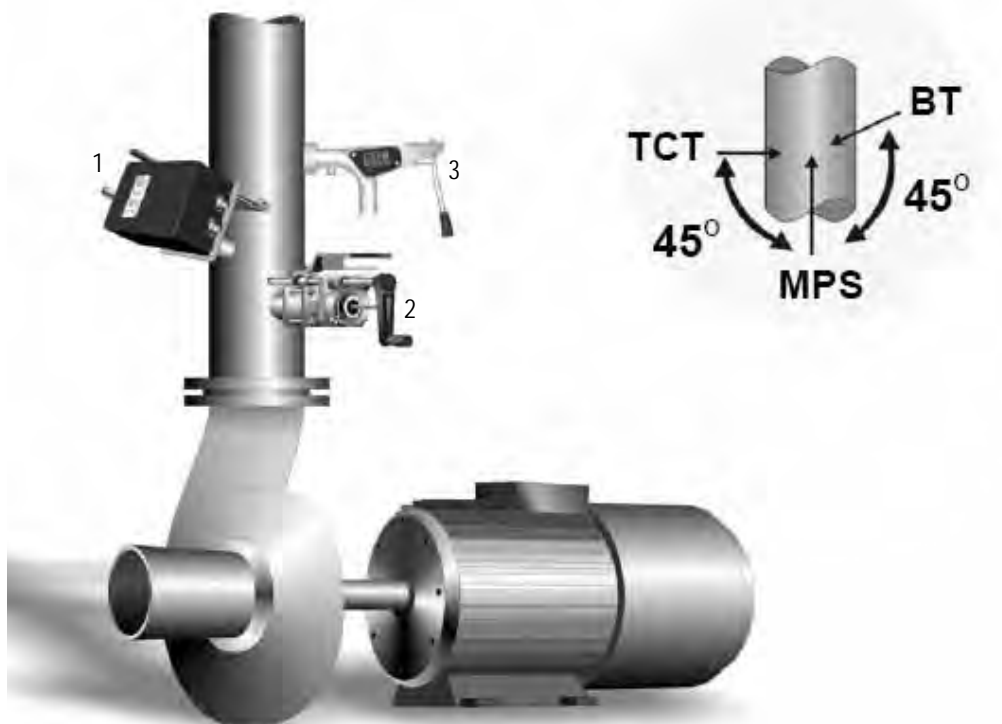
Careful location of the transmitter is essential for optimum performance and ease of maintenance.

The transmitter can be installed in a vertical, horizontal or inclined pipe. If installed in a horizontal or inclined pipe, care should be taken in locating it so that it does not measure large air bubbles trapped in the pulp.

Fig 9 shows a typical installation, the BT, TCT, and MPS can be installed close to a pump. Your BTG sales engineer will be pleased to assist in selecting the location that will give results that are consistent with your specific control strategy.

**Fig 9 Typical sensor installation**

- 1 Brightness Transmitter BT-5400
- 2 Total Consistency Transmitter TCT-230X
- 3 BTG Sampling valve type MPS-1000



#### Important recommendations:

The following points should be considered must seriously:

1. Proximity to bends or elbows in pipes is to be avoided due to turbulence and dewatering. For optimum results when the transmitter is positioned downstream of a pump or pipe elbow, it should be located at the outer turn of the pulp stream. See Fig 10, Fig 11, Fig 12 and Fig 13.

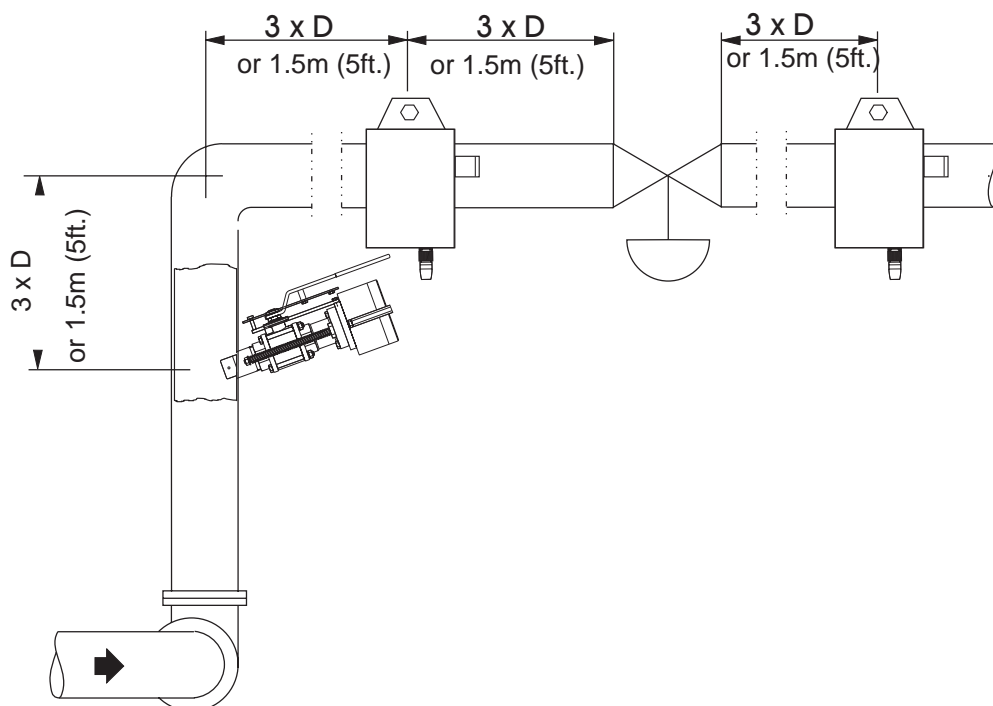
2. If the transmitter must be installed in a difficult-to-reach position, build a platform that will make it more easily accessible for service and inspection.
3. Choose a location with sufficient room for insertion and removal of the transmitter and for opening its covers. The overall length of the transmitter is 363 mm (14 in.). Remember to leave sufficient room for insertion and removal.
4. Install the transmitter so that it is protected from direct mechanical damage. Install under a roof overhang if there is any risk of frequent water or pulp spray.
5. Protect the transmitter from heavy vibration such as cavitating or unbalanced pumps. One method is to install a rubber bellows in the line.
6. Install the transmitter where the flow is above 1 m/s (3.3 ft./s) with well mixed pulp that is consistency controlled.
7. Avoid tower and stand pipes.
8. Avoid colored liquid, choose installation after washer

**Fig 10 Recommended minimum calming length - distance between pipe elbow/shut-off valve and transmitter**

The minimum distance the transmitter should be located from a bend or elbow is:

The diameter of the pipe multiplied by 3 or 1.5 m (5 ft.).

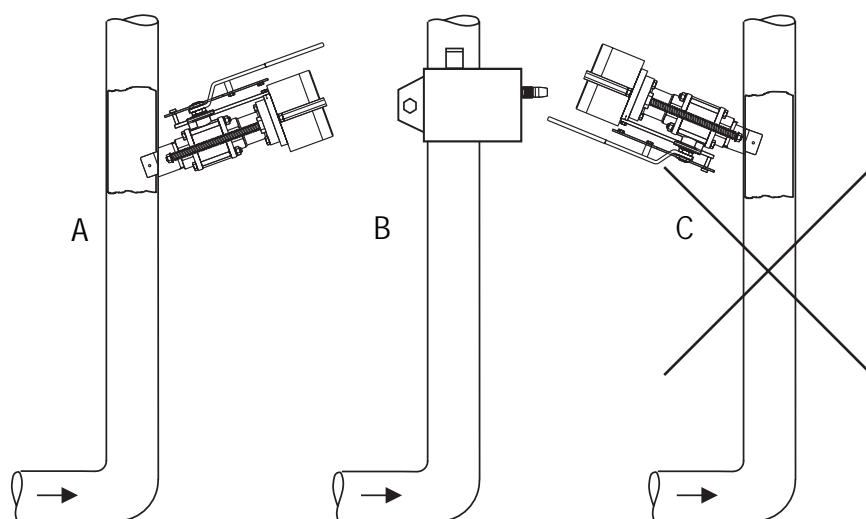
Always choose the largest value of the calculated measures.



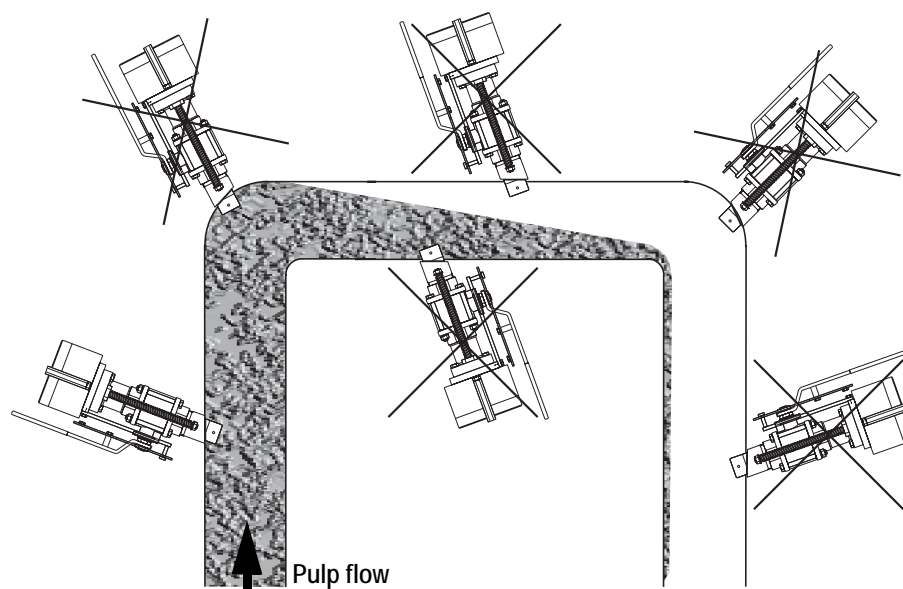
**Fig 11 Installation of the transmitter in relation to a pipe elbow**

**NOTE!**

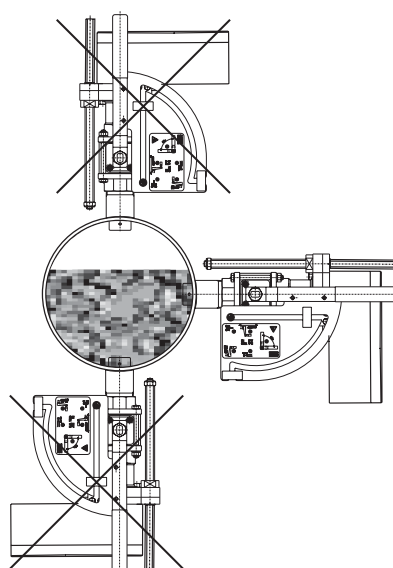
Alt. A is the most suitable if possible, avoid using alt. C.



**Fig 12 Installation of the transmitter in relation to pulp flow and pipe elbows.**



**Fig 13 Installation of the BT-5400 transmitter in a horizontal pipe.**



## 7.2 Forms and Standards

### 7.2.1 Analog Configuration Sheet

Configure analog out, BT-5400								VO no.					Mix factor				
Analog out 1 Date	Name	LED	Damp	Offset	Gain	4 mA	20 mA	Blue	Red	Green	NIR	FIR					
Analog out 2 Date	Name	LED	Damp	Offset	Gain	4 mA	20 mA	Blue	Red	Green	NIR	FIR					
Analog out 3 Date	Name	LED	Damp	Offset	Gain	4 mA	20 mA	Blue	Red	Green	NIR	FIR					
Analog out 4 Date	Name	LED	Damp	Offset	Gain	4 mA	20 mA	Blue	Red	Green	NIR	FIR					
Analog out 5 Date	Name	LED	Damp	Offset	Gain	4 mA	20 mA	Blue	Red	Green	NIR	FIR					



BT-5400 Appendix  
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BT-5400, VO no.
-----------------

[illegible]

Date	Name	Blue	Red	Green	NIR	FIR	TLED

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[illegible]

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## 7.3 Software

The following versions of software are available for BT-5400:

Product	Version
BT-5400	v1.0 or higher
SPC-1000	v1.0 or higher
JCT-1100	v1.5 or higher
BT-Calibration	

### Features

- Mixing color calibrations on all analog outputs (MIX default).
- Compensation available on all 5 analog outputs.
- The SPC-1000 front menu displays signal information such as showing which LED is used for analog output.
- I-temp (internal temperature) can be set for alarm indication.

## 7.4 SPC-1000 – Menu handling

The software is straightforward to program and is very flexible. Learning to use the software in a simulated environment accelerates the learning process and makes mistakes less likely in actual process operation. The software is designed to guide the user, but calls for a basic understanding of how the transmitter works.

HELP functions and other important guidelines are displayed at critical points in the programming process.

Warning notices are included at points where incorrect programming might affect the output signal. A code query has been inserted at highly critical points in the program where basic transmitter settings could be affected.

## 7.5 Using Hart® Communication

The unit uses the Hart® standard communication protocol; for more information refer to the appropriate user instructions from the Hart® association. BTG is also able to provide advice on the relevant code instructions.

---

### NOTE!

For reliable Hart® communication to the DCS, the polling mode should be used.

Hart communication to the DCS may be inhibited during connection of the SPC-1000.

---

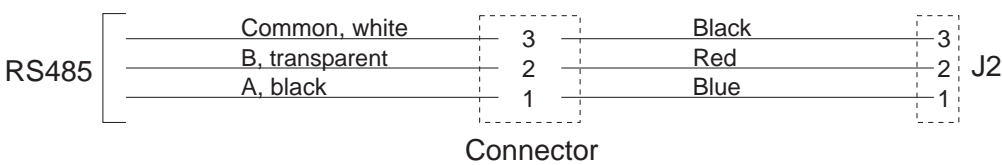
## 7.6 RS-485 Connection

### 7.6.1 RS-232 Serial Port

A PC serial port usually has a male DB-25 or DB-9 connector. A female DB-9 to male DB-25 adapter or cable is necessary if the PC has a DB-9 and the converter has a DB-25 connector. The logging program sets DTR high for powering converters without an external power supply. Some PC serial ports can not supply the power needed to drive a converter.

### 7.6.2 Connection to the Units

**Fig 14** Connection to the circuit board



### 7.6.3 Wiring

According to the RS-485 standard the wiring distance can be up to 1.2 km with up to 32 units connected. Converters with an external power supply can drive a longer line than one taking the power from the PC serial port.

## 8 JCT-1100

### 8.1 Product Introduction

This manual is valid for JCT-1100/A junction boxes.

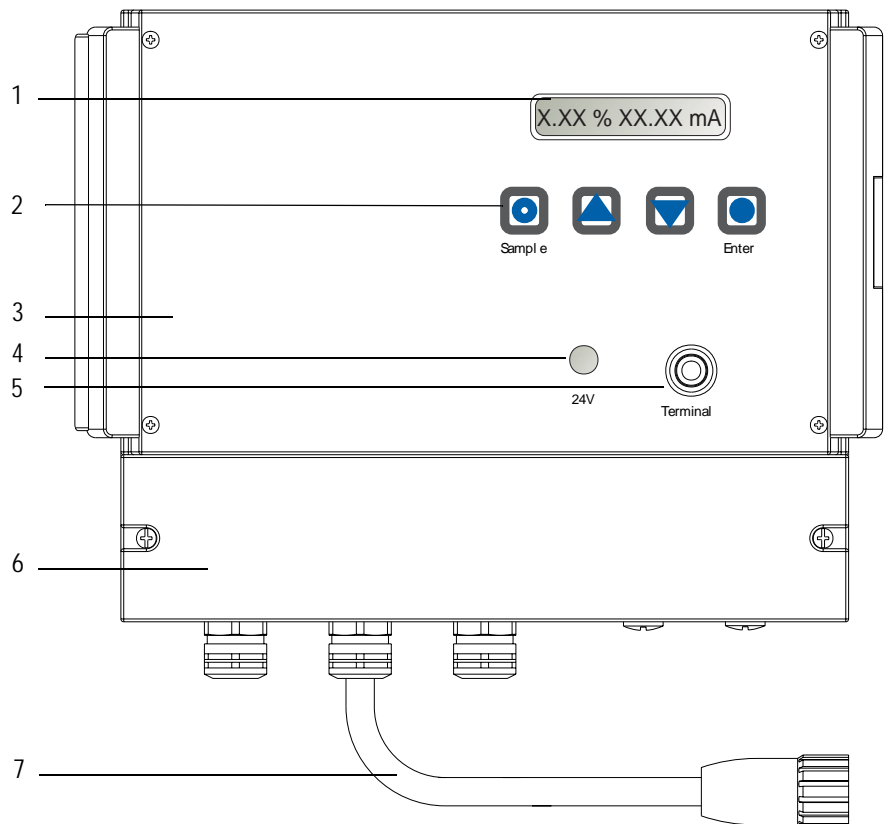
#### 8.1.1 System Description

The JCT-1100 junction box is delivered as a complete unit from BTG and is always delivered together with a transmitter. It has the following functions:

- Local display and console for basic configuration of the transmitter and the collection of measuring values for calibration using the SPC-1000
- Connection point between the transmitter, power supply and the DCS (Digital Control System)
- Local connection for a hand-held terminal SPC-1000, or for a laptop PC.

**Fig 15 Front panel overview**

- 1 Single line LCD display
- 2 Keys for access to basic settings
- 3 Front cover
- 4 LED indicating 24 V DC power on
- 5 SPC-1000 connector
- 6 Terminal connection box
- 7 System cable to transmitter



#### 8.1.2 Technical Data

**Type** JCT-1100 for BTG transmitters

**Manufacturer** BTG, Säfte, Sweden

### General

**Electronic Enclosure** Made of poly carbonate thermoplastic with a transparent cover. Nickel paint coated internally to protect against EMC interference.

**Protection rating** IP65, NEMA 4x

**Weight** Electronics box 2.0 kg (4.4 lbs)

### Signals

**Output signal** 4-20 mA. Current limited to 21 mA.  
Superimposed digital signal according to standard HART<sup>®</sup> protocol and BELL 202 modem. Follows HART<sup>®</sup> universal commands.

**Maximum loop resistance** With HART-filter: 750  $\Omega$   
Without HART-filter: 1000  $\Omega$

**Analog input** 0/4–20 mA

**Alarm function [Valid for OCT]** Solid state relay (SSR) optocoupler output.

**Measuring ranges** Four separate, individually programmable, externally connectable, using a binary-coded switch. Also accessible via the communications link.

### Communication

**Junction box** Display for viewing and buttons for adjusting span, offset, damping and calibration constants.

**Hand terminal** Using the BTG SPC-1000 hand-held terminal jack plugs into the junction box. The communication is superimposed over the 4–20 mA current loop.

**DCS** Directly with the DCS. HART<sup>®</sup> universal commands can easily be made available.

**Fieldbus** Prepared for fieldbus communication, e.g., Profibus PA or Fieldbus Foundation

### Connections



<b>Transmitter connection</b>	LIYCY 5x2x0.5, twisted pair, shielded 10 m/33 ft. cable with connector is included in the delivery. This cable is connected to the terminal strip in the junction box. Other cable lengths are available on request, max. 100 m/328 ft.
-------------------------------	--

<b>Cable fittings</b>	Brass, nickel coated.
-----------------------	-----------------------

### Supply voltage

<b>Supply voltage</b>	Built-in multi voltage power supply 100–240 V AC, 50/60 Hz (85-264 V AC, 47-63 Hz)
-----------------------	--

<b>Power consumption</b>	Maximum 60 VA for AC supply
--------------------------	-----------------------------

### Standardization and approvals

<b>Standardization</b>	Quality-assured in accordance with ISO 9001. Designed in accordance with relevant CE directives and standards. See section 8.1.5: <i>CE Declaration of Conformity</i>
------------------------	--

### Approvals



<b>Equipment type</b>	Permanently connected equipment. The product is designed for industrial use.
-----------------------	--

<b>Installation category</b>	III
------------------------------	-----

<b>Shock protection</b>	Class I
-------------------------	---------

<b>Pollution degree</b>	2
-------------------------	---

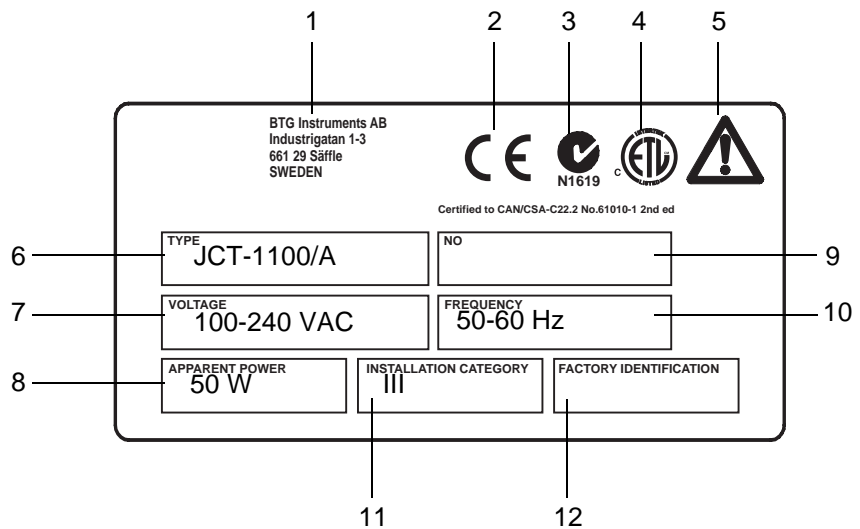
### 8.1.3 Type Sign Explanations

**NOTE!**

Always refer to the type sign when ordering spare parts.

**Fig 16 Type sign for junction box**

- 1 Manufacturer
- 2 CE-marking
- 3 C-Tick-marking
- 4 ETL-marking
- 5 Warning sign\*
- 6 Product
- 7 Voltage
- 8 Apparent power
- 9 Manufacturing number
- 10 Frequency
- 11 Installation category
- 12 Factory identification



**\*) Warning sign**

**The device is designed for industrial use. Installation, handling and service must only be carried out by trained and authorized personnel and according to relevant standards and legislation. Read the manual for detailed information and pay special attention to the warning signs!**


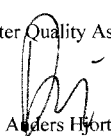
### 8.1.4 Revision Information

The following changes have been made in the JCT-1100/A compared with the JCT-1100:

- The language setting for the JCT-1100 is stored in the transmitter memory instead of the JCT-1100 memory.
- In a standard delivery the isolation amplifier has been replaced with a HART-filter in the 4-20 mA output signal. The extra 250 ohm resistor for HART communication is not required as long as the HART-filter is mounted.
- The RS-485 terminal block has been made smaller.

### 8.1.5 CE Declaration of Conformity

BTG's CE-Declaration of Conformity is only valid when the junction box is used in combination with other BTG equipment.

	
<b>CE-Declaration of Conformity</b>	
According to EN 45014	
<b>Manufacturer's Name</b>	BTG Pulp & Paper Sensors AB
<b>Manufacturer's Address</b>	P.O. Box 602 S- 661 29 SÄFFLE, Sweden
declares that the product:	
<b>Product Name</b>	Junction box
<b>Model Number</b>	JCT-1100
complies with the amendments and requirements of the:	<b>Low Voltage Directive</b> 73/23/EEC <b>EMC Directive</b> 89/336/EEC <b>RoHS</b> 2002/95/EC <b>WEEE</b> 2002/96/EC
and conforms with the following product Standards:	
<b>LVD</b>	EN 61010-1:93
<b>ETL authorisation to mark</b>	UL/CAN/CSA/-C22.2. No.61010-1, 2nd ed. -04 Control Nr. 3068754
<b>Low Voltage Power Supply</b>	NEC Class 2/IEC 60950/IEC 60601
<b>EMC</b>	EN 61000-6-4:99 EN 61000-6-2:04
<b>WEEE</b>	-n.a.-, not Annex 1
<b>RoHS</b>	-n.a.-
<b>Quality System</b>	ISO 9001 monitored by Lloyd's Register Quality Assurance
<b>Säffle,</b> <b>December 2006</b>	 Anders Hjort, MD

## 8.2 Safety Recommendations

See section 2 for safety recommendations.

## 8.3 Installation Instructions

### 8.3.1 Mounting

**NOTE!**

Locate the junction box close to the transmitter and sampling valve to achieve a convenient connection of the SPC-1000 hand-held terminal for calibration and monitoring.

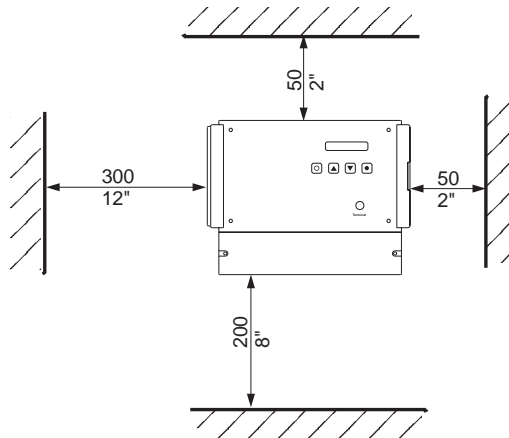
For convenient working height and a good operating position the bottom of the junction box should be approximately 1.4 m (4.6 ft.) above the floor. The SPC-1000 can be placed in a holder if one has been mounted close to the junction box.

Install the box in a position where it is protected from mechanical damage.

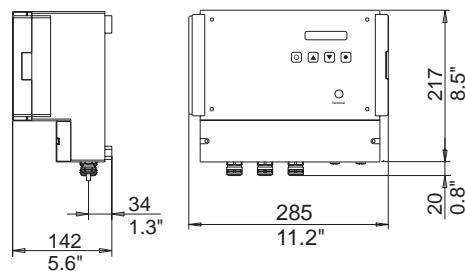
**Fig 17 Recommended clearances**

**NOTE!**

The front cover swings open and is hinged on the left side.

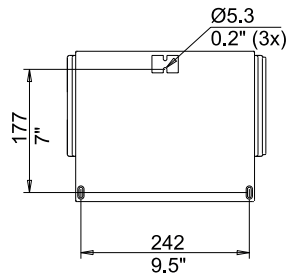


**Fig 18 Dimensions**



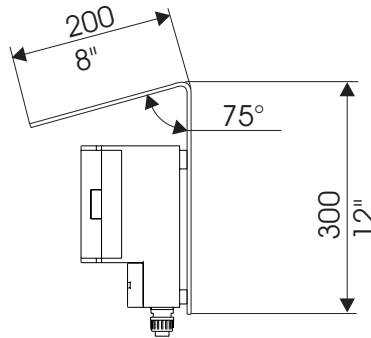
The junction box has three attachment lugs which are bolted to a flat surface.

**Fig 19 Attachment lugs**



BTG recommends that a roof or overhang is mounted above the junction box to protect it against spray and pulp. If the junction box is located outdoors, a roof should be mounted that protects from direct sunlight which can cause excessive operating temperatures. If possible, the SPC-1000 should also be protected when placed in it's holder.

**Fig 20 Protecting roof**



## 8.3.2 Cabling

### 8.3.2.1 Cable Types

BTG recommends properly dimensioned cables as described below for connections between the junction box and external equipment.

The power cable should be in accordance with the IEC 227/245 standard.

#### **Power supply cable:**

- Shielded ( $\geq 80\%$ ) 3 x 0.75 mm<sup>2</sup> (3 x AWG18) with PE.

---

#### **NOTE!**

BTG recommends that the power supply cable has a 2 A slow blow fuse.

---

#### **Signal cables (for Output, Range Select, Alarm, AUX-in, etc.):**

- Shielded (100%), twisted pair: Min 2 x 0.3 mm<sup>2</sup> (2 x AWG24). Typical size is 2 x 0.75 mm<sup>2</sup> (2 x AWG18).

---

#### **NOTE!**

BTG recommends that separate cables be used for analog and digital signals. Multiconductor cables can be used.

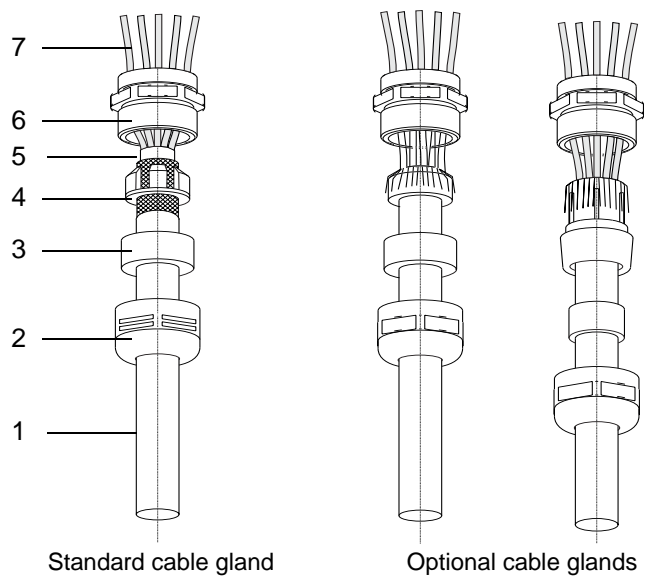
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### 8.3.2.2 Guidelines for Cable Connections

- Do not place signal cables and power supply cables close together! This may cause interference.
- Always avoid loops of cable leads in the junction box and make the leads as short as possible.
- The shields for the Alarm, AUX-in and Range select cables should not be connected in the junction box, unless the mill standard specifically requires it. Normally, these shields are grounded to instrument earth at the mill end.
- BTG recommends that the shield for the output signal cable is connected to CONN21 in the junction box. CONN21 is connected to PE via a capacitor.

**Fig 21 Grounding of cable shields**

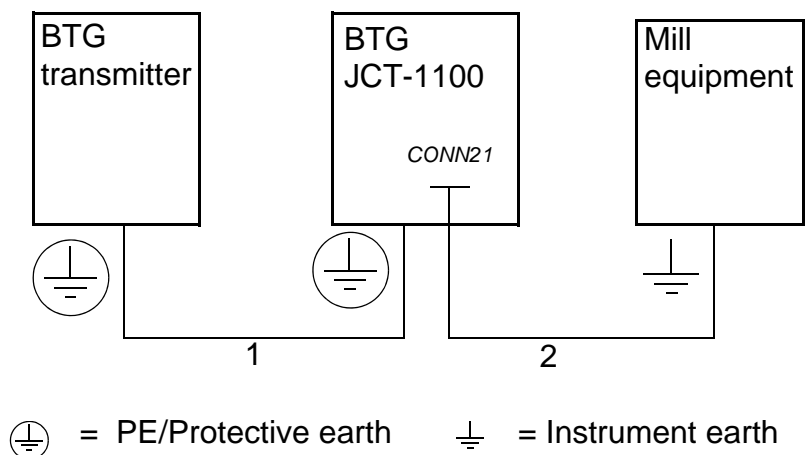
- 1 Power supply or transmitter cable
- 2 Nut
- 3 Sealing ring
- 4 Insert ring
- 5 Cable shield
- 6 Socket
- 7 Free wires



Cable shields should be connected as shown in Fig 22 below.

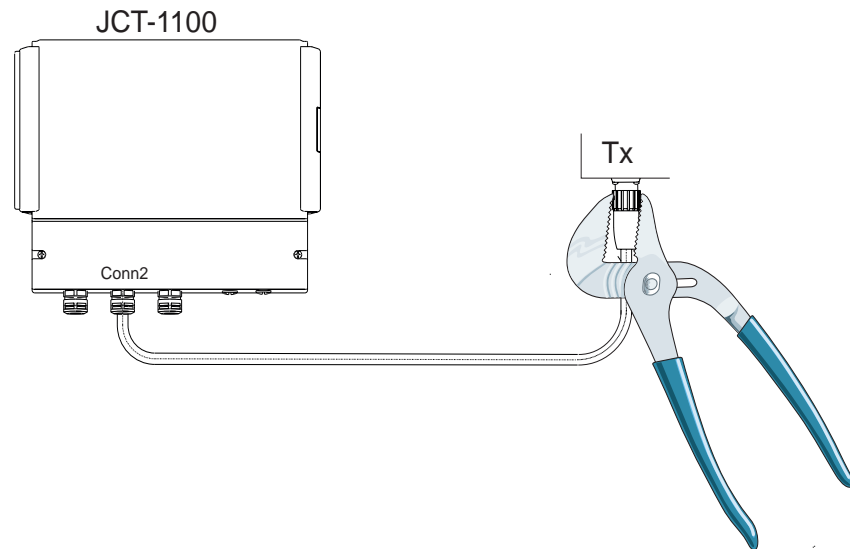
**Fig 22 Connection of signal cable shields**

- 1 System cable:  
The cable shield must be grounded to the cable glands at both ends.
- 2 Output signal cable:  
In the JCT-1100 the shield is connected to "CONN21" and in the mill equipment the shield is connected to instrument earth.



It is important to tighten the cable connector firmly to the transmitter – use a tool! If not tightened firmly, the shield will not be properly grounded.

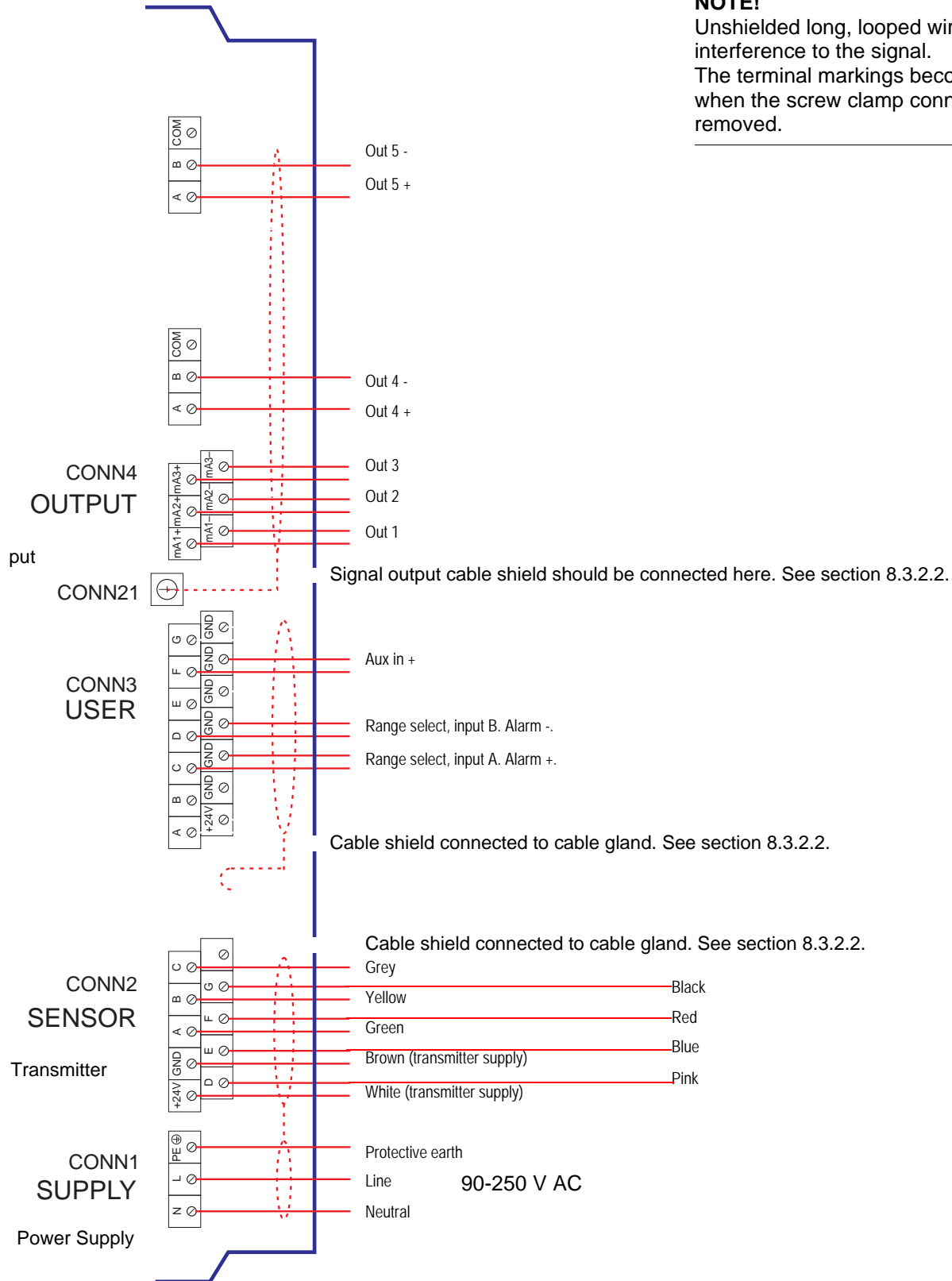
**Fig 23 Transmitter cable connection**





### 8.3.3 Wiring Diagram

Fig 24 Wiring

**NOTE!**

Unshielded long, looped wires may cause interference to the signal.  
The terminal markings become visible when the screw clamp connectors are removed.

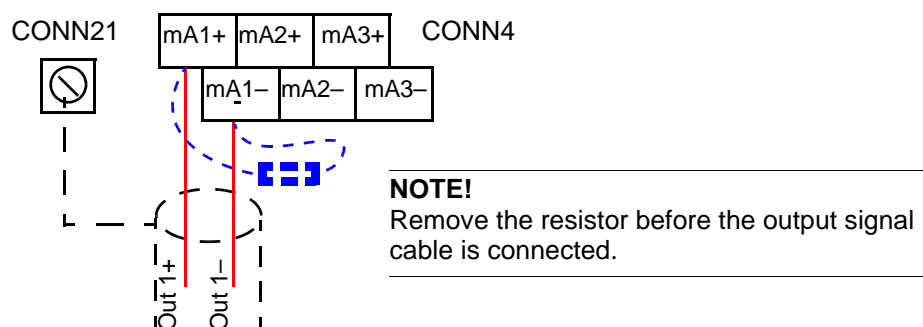
### 8.3.3.1 HART-communication

The junction box is delivered with a HART filter that removes the superimposed HART signal on the analog output signal from the junction box to the DCS, and so on. If the HART-protocol is used after the junction box, the HART filter must be removed. See section 8.5.2.1.

BTG's hand-held terminal (SPC-1000) and the display in the junction box use the HART-protocol for communication between the transmitter and the junction box. The HART communication requires a 250 ohm minimum loop resistance, which is normally provided by the HART filter. If the HART filter is removed, it must be verified that the output circuit (DCS, etc.) has at least 250 ohms resistance. If this is not the case, then an extra resistor must be connected in series with the output signal cable. Always connect the resistor to the plus (mA+) terminal.

To ensure that there is a closed 4-20 mA loop between the transmitter and the junction box, the output signal from the junction box is jumpered on delivery. This jumper must always be removed when a signal cable is connected. See figure below.

Fig 25 Removal of jumper



### 8.3.3.2 Range Select Input

Transmitter calibration ranges for different production circumstances can be changed with binary inputs to the transmitter.

Range	Input A	Input B
1	0	0
2	1	0
3	0	1
4	1	1

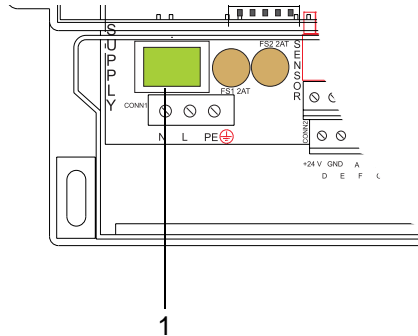
## 8.4 Operating Instructions

### 8.4.1 Starting the Junction Box

The junction box is started by switching on the power supply with the switch in the terminal box. See Fig 26 below. See the start-up instructions in the transmitter section of this manual for detailed start-up instructions.

**Fig 26 Power supply switch**

1 Power supply switch



### 8.4.2 Transmitter Configuration from the Junction Box

#### 8.4.2.1 General Information

The JCT-1100 junction box is equipped with a display and four push buttons. The display has one row of sixteen characters. The operator can make some basic adjustments using the push buttons and the display without using the hand-held terminal SPC-1000.

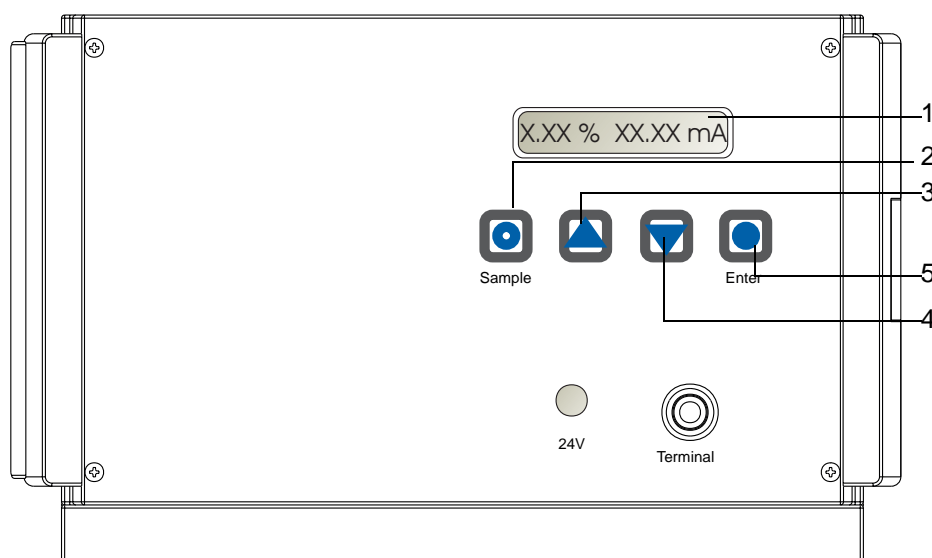
To make a complete calibration or to configure some major settings the SPC-1000 must be used. The transmitter settings made from the junction box can be loaded into the SPC-1000. There they may be used for documentation, print-out, or backup.

#### **NOTE!**





Do not configure the transmitter from the hand-held terminal and the junction box at the same time. Valuable configuration data can be lost! Always close a configuration session by updating the transmitter.

**Fig 27 Front panel with push buttons and display**

- 1 Display
- 2 Sample button
- 3 Arrow up button
- 4 Arrow down button
- 5 Enter button



The push buttons have the following functions (depending upon position in menu structure):

Push button	Function
Sample 	Reads a measurement value from the transmitter that corresponds to a calibration sample value
Arrow up 	Scrolls up in the menu structure Change a value upwards Discard a sample value
Arrow down 	Scroll down in the menu structure Change a value downwards Discard a sample value
Enter 	Select menu options Moves the cursor to the right Stores entered values and calibration samples

### 8.4.2.2 Menu Structure

**NOTE!**

The display on the junction box always returns to the Result display after 15 seconds of inactivity, or after three minutes if a message has been shown. If data was changed, it is automatically saved to the transmitter.

**Start up display**

BT-5400 UV/IR



The transmitter type is displayed when the JCT-1100 has established contact with the transmitter.

While reading or writing data "Wait..." is displayed.

**Result display**

1: 76.6% ISO

Result display: shows the process value.

To access the main menu items, press the up or down on the arrow buttons:  .

**Result display**

1: 13.5 mA

Result display: shows the output signal 4 - 20 mA.

**Channel setting**

CHANNEL 1

Channel 1-5.

**Range setting**

RANGE 1

The present measuring range. Can be changed to access other ranges (ranges 1, 2, 3 or 4).

**Span setting**

50.0 - 95.0

Measuring span, % ISO.

**Offset adjustment**

OFFSET +0.00

Process value offset, if required.

**Gain**

GAIN 1.00

Process value gain.

**Damping setting**

DAMPING 0

Damping on output signal, if required.

**JCT Communication**

JCT COMM. ON

Communication ON or OFF between the JCT and the transmitter.

### 8.4.2.3 Collecting Samples and Changing Settings

#### Collecting samples

1: 76.6% ISO




When the Result display is shown samples can be collected to calibrate the transmitter.

Press the sample button  and collect a process sample for lab calibration.

Sampling X(5)

The "X" in "X(5)" will increment as each value is stored. When all values have been stored, an average sample value will be calculated and displayed.

45.5 OK?


Save the sample value by pressing enter , or discard the sample value by pressing  or .

NOT SAVED

"NOT SAVED" is displayed if the sample value is discarded. Press any button to finish sampling procedure.

SAMPLE SAVED

"SAMPLE SAVED" is displayed if the sample value is saved.

Press enter , to display sample date (note the date).

#### NOTE!

Always mark the lab sample with date and time. The lab sample value for the corresponding calibration cannot be entered from the JCT-1100. The BT-Calibration software must be used.


#### Date

Date 2007-03-08

Press enter , to display sample time (note the time).


#### Time

Time 11:17:00




Press enter , to complete and finish sampling procedure.

### Channel setting

CHANNEL 1


Press enter  to select another channel.

1




Press  or  to choose a channel to view/edit.  
Verify by pressing enter .

### Range setting

RANGE 1

Press enter  to select another range.

1


Press  or  to choose a Range. Verify by pressing enter .

Note! The transmitter will continue operating with the range set by the Range select switch and the output signal will not change.




All Range specific parameters (Span, Offset, Damping & Calibration) can be changed for each Range. However, the changes will not take affect until the transmitter's range is changed via the Range select switch.

### Span setting

SPAN 0.50-2.00

Press enter  to change the Span.

0.50-2.00


When the first number starts to blink press  or  to change the number. Press enter  to accept. The next number will blink. Repeat the procedure until done.

SPAN 1.00-2.50




After the last value has been entered, the new span is set.

## Offset adjustment

OFFSET +0.00

Press enter  to change the offset.

+0000.0000




The sign character starts to blink. Press  or  to change the sign or number. Press the enter  to accept. The next number will blink. Repeat the procedure until done.

## Gain

GAIN 1.00


Press enter  to change the gain.

1.00




The first number starts to blink. Press  or  to change the value. Press enter  to accept. The next number will blink. Repeat the procedure until done.

## Damping setting

DAMPING 0

Press enter  to change the damping value.

00

The first number starts to blink. Press  or  to change the number. Press enter  to accept. The next number will blink. Repeat the procedure until done.

## JCT Communication

JCT COMM. ON/OFF

Enter  toggles communication ON or OFF.

Auto returns to ON after 30 minutes. Should always be set to OFF when the SPC-1000 is used.



## 8.5 Service Instructions

### 8.5.1 Maintenance Routines

No special maintenance routines are required. However, it is recommended that the following preventive maintenance is carried out:

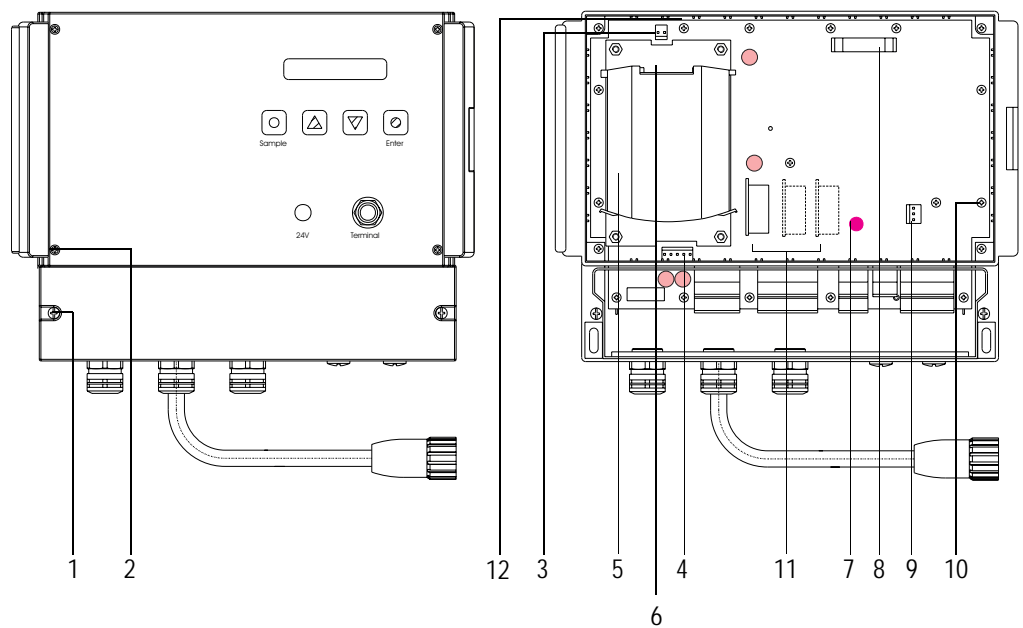
- Check that the junction box is not damaged and complies with the protection rating (IP65).
- Check that the cables to and from the junction box are not damaged.
- Keep the junction box clean and free from pulp, etc.

### 8.5.2 Service Hardware

The different hardware components are identified in Fig 28 below:

**Fig 28 Hardware components**

- 1 Screws for terminal cover (2x)
- 2 Screws for front panel (4x)
- 3 24 V DC connector
- 4 AC power connector
- 5 AC power supply
- 6 Mounting plate for power supply unit
- 7 24 V DC LED
- 8 Display connector
- 9 SPC-1000 connector
- 10 Screws for main circuit board (15x)
- 11 HART-filter (farthest to the left) or isolation amplifiers
- 12 Screw for front panel grounding strap



### 8.5.2.1 Handling of Circuit Boards for Output Signals

Upon delivery a HART-filter on a separate circuit board is mounted (see Fig 29 below). No isolation amplifiers are mounted.

The HART-filter circuit board can be replaced with an isolation amplifier, or removed as required. If the circuit board is removed and not replaced, then the connector pins have to be strapped in order to get an output signal. See Fig 29 below.

It is possible to mount isolation amplifiers for up to three analog output signals (depending upon the transmitter type) in the junction box.

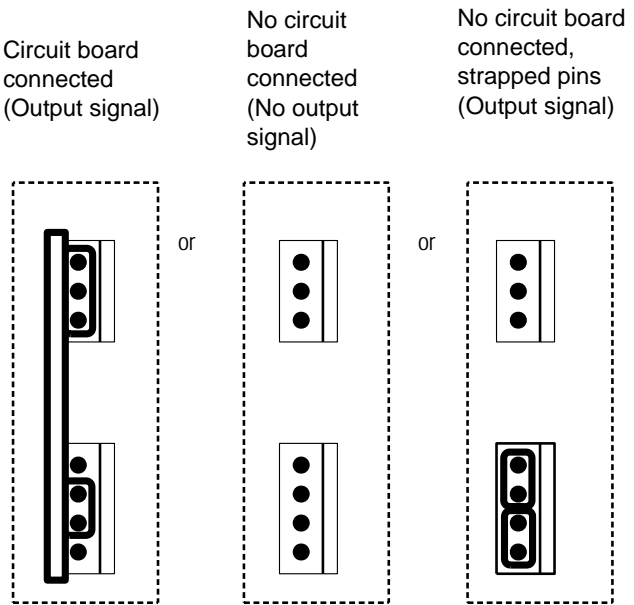
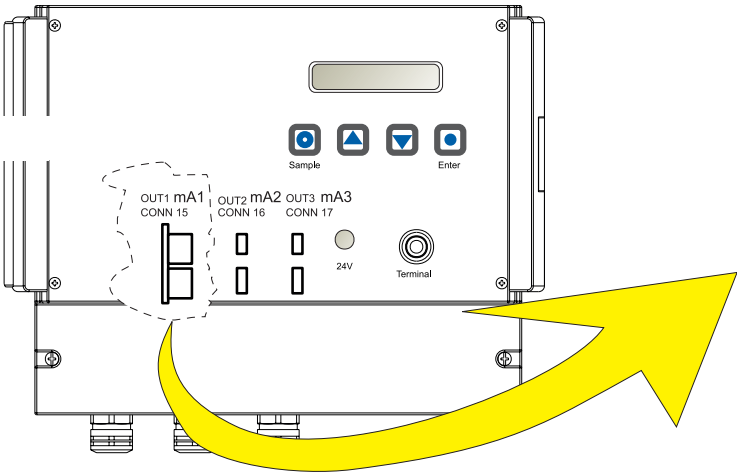
The front panel has to be removed before the circuit boards can be replaced, or removed. See section 8.5.2.3.



**DANGER!**  
High voltage within the  
junction box.

**Fig 29 Mounting of circuit boards  
for HART-filter, circuit boards  
for isolation amplifiers, or  
strapping of outputs.**

Position of isolation amplifiers under  
the front panel



### 8.5.2.2 Replacing the Power Supply Unit

If the power supply is faulty, it needs to be replaced.

<b>Tools required:</b>
Star screwdriver (medium size)



**DANGER!**  
High voltage within the junction box. Connections may only be carried out by qualified personnel.

**NOTE!**

Break and secure the AC power supply voltage to the junction box before the front panel is removed (it is not sufficient to turn it off with the power supply switch in the terminal box.).

**All numbers within () below refer to Fig 28.**

1. Check that the 24 V DC LED (7) and the display are off.
2. Unscrew the front panel (2) and carefully lift the front panel plate aside.
3. Detach the display connector (8) by pushing the two levers aside and pulling the connector straight out from the main circuit board.
4. Detach the SPC-connector (9) by pulling it straight out from the main circuit board. It might be necessary to loosen the locking flap using a flat screw driver.
5. Unscrew the front panel grounding strap (12) from the main circuit board.
6. Detach connectors for 24 V DC (3) and AC power (4) from the main circuit board.
7. Detach the power supply unit from its mounting plate by pushing the black lever (located on the right upper corner) to the left.
8. Lift out the power supply unit (5).
9. Move the wiring for 24 V DC (3) and AC power (4) from the faulty power supply unit to the new power supply unit.

**To mount the new power supply unit, perform the steps above in reverse order.**



**DANGER!**  
High voltage within the junction box. Connections may only be carried out by qualified personnel.

### 8.5.2.3 Replacing the Front Panel

If there is something wrong with the display or the push buttons, then the whole front panel has to be replaced. However, the transmitter will still work properly without the display or the buttons functioning in the junction box. This allows the replacement to be made at a convenient time.

<b>Tools required:</b>
Star screwdriver (medium size)

**NOTE!**

Break and secure the AC power supply voltage to the junction box before the front panel is removed (it is not sufficient to turn it off with the power supply switch in the terminal box.)

**All numbers within () below refer to Fig 28.**

1. Check that the 24 V DC LED (7) and the display are off.
2. Unscrew the front panel (2) and carefully lift the front panel plate aside.
3. Detach the display connector (8) by pushing the two levers aside and pulling the connector straight out from the main circuit board.
4. Detach the SPC-connector (9) by pulling it straight out from the main circuit board. It might be necessary to loosen the locking flap using a flat screw driver.
5. Unscrew the front panel grounding strap (12) from the main circuit board.
6. Move the display wiring (8) from the faulty display panel to the new display panel.

**To mount the new front panel, perform the steps above in reverse order. If the front panel sticker is not mounted, it is easier to mount it after the front panel has been replaced in the junction box.**

### 8.5.2.4 Replacing the Main Circuit Board

If the main circuit board is faulty, it needs to be replaced.

#### Tools required:

Screwdriver (medium size)  
Star screwdriver (medium size)



**DANGER!**  
High voltage within the  
junction box. Connections  
may only be carried out by  
qualified personnel.

#### NOTE!

Break and secure the AC power supply voltage to the junction box before the front panel is removed (it is not sufficient to turn it off with the power supply switch in the terminal box.).

*All numbers within () below refer to Fig 28.*

1. Check that the 24 V DC LED (7) and the display are off.
2. Unscrew the terminal box cover (1).
3. Detach all screw clamp connectors with cables connected to them. Note that the terminal screws do not need to be fully removed, the contact can be pulled out of the screw clamp connector on the main circuit board.
4. Unscrew the front panel (2) and carefully lift the front panel plate aside.
5. Detach the display connector (8) by pushing the two levers aside and pulling the connector straight out from the main circuit board.
6. Detach the SPC-connector (9) by pulling it straight out from the main circuit board. It might be necessary to loosen the locking flap using a flat screw driver.
7. Unscrew the front panel grounding strap (12) from the main circuit board.
8. Unscrew the fifteen screws (10) that attach the main circuit board to the box.
9. The main circuit board can now be removed. Space is tight, so be careful. Lift out the upper part first (where the display connector (8) is located).

**To mount the new main circuit board, perform the steps above in reverse order.**

### 8.5.3 Service Software

Software can only be serviced by BTG's technicians. Contact BTG regarding any suspected software problems.

## 8.5.4 Troubleshooting

This section only covers troubleshooting with regards to possible faults that can occur in the junction box. Please consult the transmitter part of this manual for transmitter related problems.

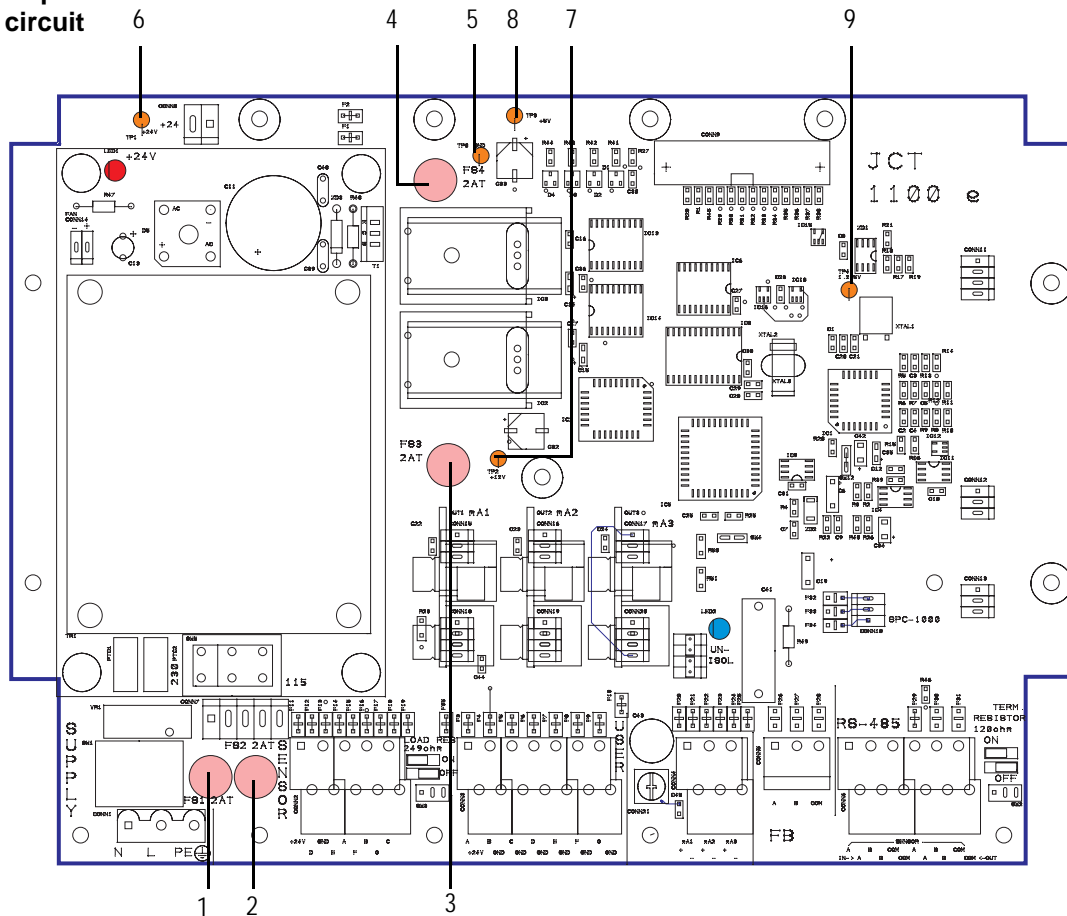
In the trouble shooting table below the probable causes are listed in a logical order. They should be checked in that order.

***The fuses and the test points indicated in the troubleshooting table below are shown in Fig 30. All numbers within ( ) in the troubleshooting table below refer to Fig 28.***

Symptom	Probable cause	Action
1. The junction box does not power up.	1.1. No power to the junction box	Check the external power supply voltage.
	1.2. Fuse on main circuit board blown	Check fuses. FS1 and FS2 for AC power supply, FS3 for 24 V DC to transmitter, and FS4 for DC/DC converters.
	1.3. Faulty or incorrectly connected cabling to the power supply unit	Check the AC power (4) and 24 V DC (3) wiring.
	1.4. Faulty 24 V DC supply	Check TP1. If out of limits, replace the power supply unit. See section 8.5.2.2.
	1.5. Faulty DC/DC converters on main circuit board	Check TP2 and TP3. If out of limits, replace the main circuit board. See section 8.5.2.4.
2. There is no information on the display.	2.1. No power to the junction box	See point 1 above.
	2.2. Faulty or incorrectly connected display wiring	Check the display wiring (8) and the grounding strap (12).
	2.3. Display is faulty	Replace the front panel. See section 8.5.2.3.
3. Nothing happens when the push buttons are used.	3.1. Faulty or incorrectly connected display wiring	Check the display wiring (8) and the grounding strap (12).
	3.2. One, or more push buttons are faulty	Replace the front panel. See section 8.5.2.3.
4. There is no output signal.	4.1. No power to the junction box	See point 1 above.
	4.2. Transmitter not in operation.	Check the display for output signal

Symptom	Probable cause	Action
	4.3. Improperly mounted HART-filter or isolation amplifier	Check if the HART-filter or isolation amplifier is correctly mounted. See section 8.5.2.1.
	4.4. Open loop for 4-20 mA output	Check the complete 4-20 mA loop for breaks.
	4.5. Incorrect transmitter analog out configuration	See the transmitter part of this manual for calibration instructions.
	4.6. Faulty HART-filter or isolation amplifier	Replace, or remove the isolation amplifier circuit board. See section 8.5.2.1
5. The SPC does not work.	5.1. Incorrect program running in the SPC	Switch to correct sensor card and program in the SPC.
	5.2. Not enough resistance (minimum 250 $\Omega$ ) in the 4-20 mA output loop	If the output signal is connected to a DCS, check that the total loop resistance is between 250 $\Omega$ and 750 $\Omega$ (with HART-filter) or between 250 $\Omega$ and 1000 $\Omega$ (without HART-filter).
	5.3. The analog output signal is not between 4-20 mA	See point 4 above.
	5.4. Faulty or incorrectly connected SPC cable	Check the connectors and cabling from the SPC to the main circuit board (9).
	5.5. Faulty Hart communication with the SPC	Check that the SPC functions correctly. If it does, it is necessary to replace the main circuit board. See section 8.5.2.4
6. The analog output signal from the junction box is lower than what the display display shows.	6.1. Faulty HART-filter or isolation amplifier	Replace, or remove the circuit board. See section 8.5.2.1
	6.2. Incorrect transmitter analog out configuration	See the transmitter part of this manual for calibration instructions.

**Fig 30 Fuses and test points on the main circuit board**



Pos	TP	Label	Min.	Max	Unit	Comment
1		FS1		2	A	Fuse for AC power supply: 250V, 2AT
2		FS2		2	A	Fuse for AC power supply: 250V, 2AT
3		FS3		2	A	Fuse for 24 V DC power supply: 250V, 2AT
4		FS4		2	A	Fuse for DC/DC converters: 250V, 2AT
5	TP0	GND				Ground reference for all voltages (test points)
6	TP1	+24V	23.5	24.5	V	Output voltage from 24 V DC power supply
7	TP2	+12V	11.5	12.5	V	SPC-1000 supply voltage from DC/DC converter
8	TP3	+5V	4.95	5.05	V	Regulated system supply voltage from DC/DC converter
9	TP5	1.23V	1.20	1.25	V	Reference voltage for HART modem

**Measure all TP's between TP0 (GND) and the TP at hand using a high impedance digital voltmeter**



## 8.6 Parts List

### 8.6.1 JCT-1100

Item No.	Rec. spare parts	Qty	Part No.	Spare Part	Description
	(*)		A0012070	Junction box, complete	100-240 V AC version
10		1	A0012146	Main circuit board, with power supply unit	
11		1	27014281	Shield gasket	
12		1	A0006635	Terminal connection	SPC
13		1	A0068726 A0014274	HART-filter (included) Isolation amplifier (optional)	
14		1	A0012229	System cable	Transmitter
15	*	4	46022638	Fuse	TR5 2AT 250V
16		2	46028221	Cable gland	M12
17		1	46028130	Cable gland	M20
18	(*)	1	46027330	Power supply unit	Pulse
19		1	A0012203	Front panel, complete - without sticker	
20		1	XXXXXX	Front panel sticker	
21		1	XXXXXX	Sticker, inside terminal box	
22		1	A0012112	Junction box	

