## FEATURES

- **100V / 1A OPEN DRAIN OUTPUT WITH REVERSE POLARITY PROTECTION**
- **RESOLUTION: BETTER THAN 2 uA**
- **THE WHOLE SWITCH IS BUILT-IN THE HEAD - IT IS JUST THE PROBE AND A THIN CABLE COMING OUT OF IT**
- **HIGH ISOLATION**
- **POTENTIAL FREE ELECTRODES - THE MEASUREMENT DOES NOT CHANGE OR POLARIZE THE LIQUID**
- **THE CONDUCTIVITY THRESHOLD IS FIELD PROGRAMMABLE FROM 0 TO 20 000 uS/cm**
- **THE HYSTERESIS IS FIELD PROGRAMMABLE FROM 1 TO 40 %**
- **FIELD PROGRAMMABLE TEMPERATURE COEFFICIENT FROM 0.00 TO 10.00 % / ºC**
- **SINGLE TempCo OR A 10 POINTS CURVE**
- **LIQUID TEMPERATURE: -20 TO +120 ºC**
- **AMBIENT TEMPERATURE: -30 TO +80 ºC**
- **KYNAR PVDF BODY AND GRAPHITE ELECTRODES ENSURE VERY HIGH CHEMICAL AND WEAR RESISTANCE**
- **PLATINUM RTD ENSURES VERY ACCURATE TEMPERATURE MEASUREMENT AND COMPENSATION**
- **ONE POINT FIELD CALIBRATION**
- **IP67 (NEMA-6) PROTECTION ON THE ELECTRONICS**
- **WEIGHT: 180 g (6.3 oz)**
- **DIMMENSIONS: (dia)33.3 mm x (L)110 mm ((dia)1.32” x (L)4.33”)**

## APPLICATIONS

- **WATER TREATMENT**
- **COOLING TOWERS**
- **WATER TOWERS**
- **LABORATORY MEASUREMENTS**

## 1. DESCRIPTION

GCS20K is a low power conductivity switch with an 100V / 1A open drain output. Both the conductivity threshold and the hysteresis are field programmable. The output action can be normal or inverse, programmable.

The temperature coefficient can be programmed at any time in the field from 0.00 to 10.00 %/ºC. The reference temperature is also programmable allowing greater flexibility and various options for temperature compensation.

GCS20K also offers a 10 points curve for temperature compensation. Switching between the single temperature coefficient and the curve can be done at any time on the field in a second. This way the temperature compensation can be done accurately in a very large temperature range.

The calibration is one point only and can be done in the field through the programming port of GCS20K in a couple of minutes.

Using high quality materials and our proprietary circuits and algorithms ensures high accuracy, reliability, flexibility and long time without service.

## 2. ABSOLUTE MAXIMUM RATINGS *

| | |
|---|---|
| Liquid temperature | -20 °C to +120 °C |
| Ambient temperature | -30 °C to +80 °C |
| Power supply voltage | 40 VDC |
| Voltage to the switch output | 100 VDC |

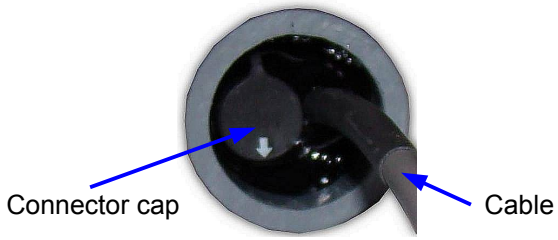
*** NOTE: Stresses above those ratings may cause permanent damage to the device.**

## 3. CHARACTERISTICS

| Parameter | Conditions | Min | Typical | Max | Units |
|---|---|---|---|---|---|
| **Power supply voltage** | -30 °C to +80 °C | 8.5 | | 36 | V DC |
| **Consumption** | -30 °C to +80 °C | | | 16 | mA |
| **Switch Output** | | | | | |
| Voltage | -30 °C to +80 °C, output is OFF | | | 100 | V DC |
| Current | 25 °C | | | 1.0 | A DC |
| **Temperature Error** | Liquid temperature from -20 °C to +120 °C | | 0.3 | 0.5 | °C |
| **Conductivity Error** | 25 °C | | TBD | | |
| **Materials** | | | | | |
| Head body | Kynar PVDF | | | | |
| Electrodes | Graphite | | | | |
| Transmitter body | CPVC | | | | |
| **Mechanical** | | | | | |
| Thread | 1” NPT, undersized | | | | |
| Wrench | 1-1/16” thin head wrench | | | | |
| **Programming port** | 5 V TTL RS232, MODBUS RTU | | | | |
| **Cable** | 3 wire, 180 cm (6') long | | | | |

## 4. PROGRAMMING

GCS20K has a programming port located on the back, next to the cable. The connector has a water-tight cap. Remove the cap and connect the programmer GFP23 (PN 30560).




**NOTE: Make sure to replace the cap after programming.**

GFP23 is a USB to 5V TTL RS232 converter with the proper connector at the end of its cable.
The programming can be done using our software or a third party software using a PC or a lap top on the field.

The communication port of GCS20K is 3 wire 5V TTL RS232. Its settings are: 19 200, 8 bit character, even parity, 1 stop bit, no handshaking. The protocol used for communication is MODBUS RTU. Functions 0x03 (read holding registers), 0x04 (read input registers) and 0x06 (write single register) are implemented. GCS20K handles exceptions 1, 2 and 3. The default MODBUS address is 1 and it can not be changed.

Here are the registers used:

| ***Register address*** | ***Register Type*** | ***Read/Write*** | ***Description*** | ***Format*** |
|---|---|---|---|---|
| 20 | Input | R | Conductivity in uS/cm<br>0 to 20 000 | 12 550 = 12 550 uS/cm |
| 1006 | Holding | R/W | Conductivity Threshold in uS/cm<br>0 to 20 000 | default is 1000 uS/cm |
| 1007 | Holding | R/W | Hysteresis in percents<br>0 to 400 = 0.0 to 40.0 % | default is 100 = 10.0 % |
| 1008 | Holding | R/W | Switch Action<br>0 = normal, 1 = inverse | Default is 0 = normal |
| 1009 | Holding | R/W | Alarm Delay in seconds<br>1 to 1000 s | Default is 20 s |
| 1010 | Holding | R/W | Temperature coefficient<br>0 to 1000 = 0.00 to 10.0 %/°C | default is 200 = 2.00 %/°C |
| 1012 | Holding | R/W | Reference Temperature , **NOTE 1**<br>-200 to +1200 = -20.0 °C to +120 °C | default is 250 = 25.0 °C |
| 1013 | Holding | R/W | Curve<br>0 = single TempCo, 1 = Curve | default is 0 = single TempCo |
| 1014 | Holding | R/W | Temperature for **Point 0**, **NOTE 1, NOTE 2**<br>-200 to +1200 = -20.0 °C to +120 °C | default is -200 = -20.0 °C |
| 1015 | Holding | R/W | Temperature coefficient for **Point 0**<br>0 to 1000 = 0.00 to 10.0 %/°C | default is 200 = 2.00 %/°C |
| 1016 | Holding | R/W | Temperature for **Point 1**, **NOTE 1, NOTE 2**<br>-200 to +1200 = -20.0 °C to +120 °C | default is 1200 = +120.0 °C |
| 1017 | Holding | R/W | Temperature coefficient for **Point 1**<br>0 to 1000 = 0.00 to 10.0 %/°C | default is 200 = 2.00 %/°C |
| 1018 | Holding | R/W | Temperature for **Point 2**, **NOTE 1, NOTE 2**<br>-200 to +1200 = -20.0 °C to +120 °C | default is 1200 = +120.0 °C |
| 1019 | Holding | R/W | Temperature coefficient for **Point 2**<br>0 to 1000 = 0.00 to 10.0 %/°C | default is 200 = 2.00 %/°C |
| 1020 | Holding | R/W | Temperature for **Point 3**, **NOTE 1, NOTE 2**<br>-200 to +1200 = -20.0 °C to +120 °C | default is 1200 = +120.0 °C |
| 1021 | Holding | R/W | Temperature coefficient for **Point 3**<br>0 to 1000 = 0.00 to 10.0 %/°C | default is 200 = 2.00 %/°C |
| 1022 | Holding | R/W | Temperature for **Point 4**, **NOTE 1, NOTE 2**<br>-200 to +1200 = -20.0 °C to +120 °C | default is 1200 = +120.0 °C |
| 1023 | Holding | R/W | Temperature coefficient for **Point 4**<br>0 to 1000 = 0.00 to 10.0 %/°C | default is 200 = 2.00 %/°C |
| 1024 | Holding | R/W | Temperature for **Point 5**, **NOTE 1, NOTE 2** | default is 1200 = +120.0 °C |

| | | | | |
|---|---|---|---|---|
| | | | -200 to +1200 = -20.0 °C to +120 °C | |
| 1025 | Holding | R/W | Temperature coefficient for **Point 5**<br>0 to 1000 = 0.00 to 10.0 %/°C | default is 200 = 2.00 %/°C |
| 1026 | Holding | R/W | Temperature for **Point 6**, **NOTE 1, NOTE 2**<br>-200 to +1200 = -20.0 °C to +120 °C | default is 1200 = +120.0 °C |
| 1027 | Holding | R/W | Temperature coefficient for **Point 6**<br>0 to 1000 = 0.00 to 10.0 %/°C | default is 200 = 2.00 %/°C |
| 1028 | Holding | R/W | Temperature for **Point 7**, **NOTE 1, NOTE 2**<br>-200 to +1200 = -20.0 °C to +120 °C | default is 1200 = +120.0 °C |
| 1029 | Holding | R/W | Temperature coefficient for **Point 7**<br>0 to 1000 = 0.00 to 10.0 %/°C | default is 200 = 2.00 %/°C |
| 1030 | Holding | R/W | Temperature for **Point 8**, **NOTE 1, NOTE 2**<br>-200 to +1200 = -20.0 °C to +120 °C | default is 1200 = +120.0 °C |
| 1031 | Holding | R/W | Temperature coefficient for **Point 8**<br>0 to 1000 = 0.00 to 10.0 %/°C | default is 200 = 2.00 %/°C |
| 1032 | Holding | R/W | Temperature for **Point 9**, **NOTE 1, NOTE 2**<br>-200 to +1200 = -20.0 °C to +120 °C | default is 1200 = +120.0 °C |
| 1033 | Holding | R/W | Temperature coefficient for **Point 9**<br>0 to 1000 = 0.00 to 10.0 %/°C | default is 200 = 2.00 %/°C |

**NOTE 1:** This is a signed 16 bit integer

**NOTE 2:** Point 0 must have the lowest temperature and every next point must have higher temperature than the previous point. Do not skip points. Program the temperature of the unused points with 1200.

## 4.1. USING THE CURVE

Typically the temperature coefficient is not a constant and it changes with the temperature. Using a single temperature coefficient for compensating in a large temperature range may not be accurate enough. If you know how the TempCo changes in the temperature you can use the curve to improve the accuracy of the measurement. Program the points of the curve and then switch to using the curve instead of a single TempCo.

**NOTE: Point 0 must have the lowest temperature and every next point must have higher temperature than the previous point. Do not skip points. Program the temperature of the unused points with 1200.**

## 4.2. THRESHOLD, HYSTERESIS, ALARM DELAY AND ACTION OF THE SWITCH

The hysteresis is around the threshold - half of the hysteresis is above and half of it is below the threshold.

***Example: The threshold is 1000 uS/cm, the hysteresis is 20%, the alarm delay is 20 seconds and the action is normal.***

*The output will turn ON (shorting the white wire to the black wire) when the conductivity becomes higher than 1100 uS/cm and stays higher for 20 sec, all the time.*

*The output will turn OFF (open circuit between the white and the black wire) when the conductivity goes below 900 uS/cm.*

*If the action is programmed to be reverse, the output action will be reversed.*

# 5. APPLICATION

## 5.1. ELECTRICAL

The cable of GCS20K has three wires:

Red – power "+"
Black – power "-"
White – open drain (npn, sinking) ouput

## 5.2. MECHANICAL

GCS20K has 1" NPT. We strongly recommend mounting GCS20K in a CPVC sch 80, PVC or other plastic Tee.

To mount the transmitter use 1-1/16" wrench with a thin head.

**NOTE: Do not try mounting GCS20K by rotating its gray part. This may damage the electronics inside the gray CPVC piece of pipe.**

# 6. ORDERING

For ordering please use the following G Instruments part numbers:

| *Description* | *G Instruments PN* |
|---|---|
| GCS20K conductivity switch | 30524 |
| GFP23 programmer | 30560 |

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