

Solumetrix Toroidal Conductivity Sensors

Models:	BKIN50, BKEX50, BEIN75, BEEEX75
Conductivity:	Dual range, 0-20.00 mS (Compensated), 0.1 uS resolution 0-200.0 mS (Compensated), 1 uS resolution
Temperature resolution:	0.1 °C (default), 0.01 °C (Software selectable)
Temperature compensation:	0-2.55 % per °C (From 25°C), default 1.7 % per °C

Feature table:

Model	Temperature	Fixing Thread	Serial Interface	Electronics
BKIN50	0-50.0°C	½" BSP Parallel	TTL	Internal
BKEX50	0-100.0°C	½" BSP Parallel	TTL	External
BEIN75	0-50.0°C	¾" BSP Parallel	TTL	Internal
BEEEX75	0-50.0°C	¾" BSP Parallel	RS232	External

The 'B' series toroidal conductivity sensors overcome many of the difficulties associated with conventional toroidal sensors. The signal processing electronics is incorporated in the sensor's body and is permanently paired with the sensor cell. This allows the sensor to be pre-calibrated at the factory.

The sensors are calibrated on two ranges, 0-20mS (0.1uS resolution), and 0-200mS (1uS resolution).

The sensor requires a single 9-24V DC supply, and has two data lines, all in a single 4-wire unscreened cable.

The sensor communicates via a UART serial data port, allowing data to be read from the sensor, and also allowing various control functions to be carried out.

These functions are:

- Polling for data
- Range changing
- Calibration
- Temperature compensation adjustment (0.00% > 3.00%, in 0.01% steps)
- Data filtering parameter

The Sensors are compatible with the Solumetrix 4-20WD2C and 4-20ND2C transmitters, and also with the RM-33 rinse water controller.

OEM users can easily interface this device to their own input circuit requirements, needing only a 9600 baud UART, no level shifting, for lead lengths up to 300 metres.

The body of the sensor can be flange mounted and is available in two thread sizes: ½" BSP (black) or ¾" BSP (Beige).

The electronics package is incorporated in the body of the sensor for applications up to 50°C, and for higher temperatures the electronics are housed in an encapsulated module in the lead, situated close to the sensor body.

The sensor has an in-built temperature measurement circuit, and the conductivity signal is output as a digital data stream, comprising uncompensated, compensated conductivity values, together with temperature data. Temperature compensation is carried out within the sensor electronics, the default percentage value is 1.7%/°C.

The electronics package has been developed to be compliant with CE RF industrial fields and does not require any shielded cables for connection.

Probe connections.

RS232 comms version (BEEEX75)

Red	Power supply +9V to 24V DC @ 50 mA
Blue	Power supply 0V
Yellow	Serial RX (optional input, not needed for default mode) Input Levels: 0 = +3V to +24V, 1 = -3V to -24V
Green	Serial TX (output) Output Levels: 0 = +5V to +8V, 1 = -5V to -8V

TTL comms versions (BKIN50, BKEX50 and BEIN75)

Red	Power supply +9V to 24V DC @ 50 mA
Black	Power supply 0V
Brown	Serial RX (optional input, not needed for default mode) Input Levels: 0 = <1.5V, 1 = +4.0V to +5.0V
Orange	Serial TX (output) Output Levels: 0 = <0.6V, 1 = >4.3V

Data format.

9600 baud, 8 data bits, no parity, 1 stop bit, no flow control.

Probe data Output.

14 byte data packet consisting of:

Byte 1	Header check byte 1, always AA hex
Byte 2	Header check byte 2, always 55 hex
Byte 3	Probe type, always 01 hex
Byte 4	Probe Status data low byte
Byte 5	Probe Status data high byte
Byte 6	Temperature in °C x 10, low byte
Byte 7	Temperature in °C x 10, high byte
Byte 8	Uncompensated conductivity, in uS (÷10 if on 200mS range), low byte
Byte 9	Uncompensated conductivity, in uS (÷10 if on 200mS range), high byte
Byte 10	Compensated conductivity, in uS (÷10 if on 200mS range), low byte
Byte 11	Compensated conductivity, in uS (÷10 if on 200mS range), high byte
Byte 12	Checksum byte, 2's complement of the sum of bytes 1 to 11 inclusive
Byte 13	Tail check byte 1, always 55 hex
Byte 14	Tail check byte 2, always AA hex

Data transmitted every 300ms approx in default mode.

Byte	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Header 1	Header 2	Type	Status	S/W ver	Temperature		Uncompensated conductivity		Compensated conductivity		Checksum	Tail 1	Tail 2
	AA	55	01	↓	S/w Ver x 10	Low Byte	High Byte	Low byte	High byte	Low byte	High byte	↓	55	AA
Example hex data	AA	55	01	02	3E	CB	00	A0	04	06	05	48	55	AA
Decoded data			01	20mS	6.20	20.3°C		1.184mS		1.286mS				

Checksum = 2's complement of the 8 bit sum of bytes 1 to 11 inclusive.
e.g. From example above: AA+55+01+02+3E+CB+00+A0+04+06+05 = BA Hex
2's complement of BA = 46 Hex

Status byte details.

Bit	7	6	5	4	3	2	1	0
	Hi res temp	Not used		Gain range	Comms mode		Poll mode	Data mode
0	Normal	0	0	20mS	00 RS232 01 I2C		Polled	Normal
1	High Resolution	0	0	200mS	10 4-20mA 11 RS485		Continuous	Raw

Status byte description.

Bit 0	Probe data mode	0 = Normal mode, 1 = Raw mode
Bit 1	Probe poll mode	0 = Polled data mode, 1 = Continuous mode
Bits 2-3	Probe comms mode	0 = RS232, 1 = I2C, 2 = 4-20mA, 3 = RS485
Bit 4	Gain range	0 = 20mS, 1 = 200mS
Bit 5	Not used	0
Bit 6	Not used	0
Bit 7	High Res Temp mode	0 = Normal, 1 = High resolution temperature

Probe data input.

9600 baud, 8 data bits, no parity, 1 stop bit, no flow control.

10 byte data packet consisting of :

Byte 1 Header check byte 1, always AA hex
 Byte 2 Header check byte 2, always 55 hex
 Byte 3 Command
 Byte 4 Command data, low byte
 Byte 5 Command data, high byte
 Byte 6 Reserved, low byte
 Byte 7 Reserved, high byte
 Byte 8 Checksum byte, 2's complement of the sum of bytes 1 to 7 inclusive
 Byte 9 Tail check byte 1, always 55 hex
 Byte 10 Tail check byte 2, always AA hex

Byte	1	2	3	4	5	6	7	8	9	10
	Header 1	Header 2	Command	Command Data		Reserved		Checksum	Tail 1	Tail 2
	AA	55	01	Low Byte	High Byte	Low Byte	High Byte	↓	55	AA
Example hex data 1	AA	55	FD	02	00	00	00	02	55	AA
Decoded data 1			Set Averaging	Set averaging to 2		0				
Example hex data 2	AA	55	02	AA	00	00	00	55	55	AA
Decoded data 2			Poll mode	Set Temp. comp. 1.7%						

Checksum = 2's complement of the 8 bit sum of bytes 1 to 7 inclusive.

e.g. From example 2 above: AA+55+02+AA+00+00+00 = AB Hex
 2's complement of AB = 55 Hex

Command details

Command	Command data	Command Function
01 hex	Temp comp value(1)	Set probe data into continuous data mode. Probe sends data every approx. 300ms Temp comp value = %x100 e.g. 170 dec = 1.7%
02 hex	Temp comp value(1)	Set probe into polled data mode. Probe only sends data when command 02 is received. Temp comp value = %x100 e.g. 150 dec = 1.5%
03 to EF hex	Unused	
F0 to F4 hex	Reserved(3)	Reserved, do not use.
F5 hex	High res temp(2)	1 = Temperature is returned to 0.01 °C 0 = Default 0.1 °C temperature resolution.
F6 hex	Reserved(3)	Reserved, do not use.
F7 hex	Probe range(4)	Sets probe range, 0 = 20mS, 1 = 200ms If 0 conductivity = uS, if 1 conductivity = uS / 10
F8 hex	F8F8 hex	Sets probe into raw data mode which is used for calibration. Temperature and conductivity values are raw ADC results.
F9 hex	F9F9 hex	Sets probe back into normal data mode.
FA hex	Reserved	Reserved do not use
FB hex	Reserved	Reserved do not use
FC hex	Unused	
FD hex	Averaging value	Sets probe averaging value, 0 (off) to 32. Compensated conductivity value is averaged over this number of samples.
FE hex	0000 hex AF5A hex(6) F0A5 hex (6) 5F05 hex(6)	Sets probe interface to RS232 (default) Sets interface to I2C (needs specific hardware) Sets to 4-20ma (needs specific hardware) Sets interface to RS485 (needs specific hardware)
FF hex	FFFF hex(7)	Reserved do not use.

Command Notes:

1. The temperature compensation value can only be changed as part of commands 01 and 02 and must always be specified in these commands.
2. The internal calculations for the temperature compensated conductivity are always done using the high resolution (0.01°C) temperature.
3. Reserved commands will cause the probe to malfunction.
4. Default range is 0-20mS unless requested at time of ordering.
5. Confirmation of most commands can be done only by reading the appropriate bits in the Status byte in the returned data.
6. Changing the probe comms mode only comes into effect at the next power cycle. Changing the comms mode on a probe that does not support it will result in a probe that will not communicate until the comms mode is reset by sending the Command FE with Data 0000 within 200mS of powering up the probe.
7. The reset command FF will clear the probe calibration and must only be used if you are able to recalibrate it using commands FA and FB.

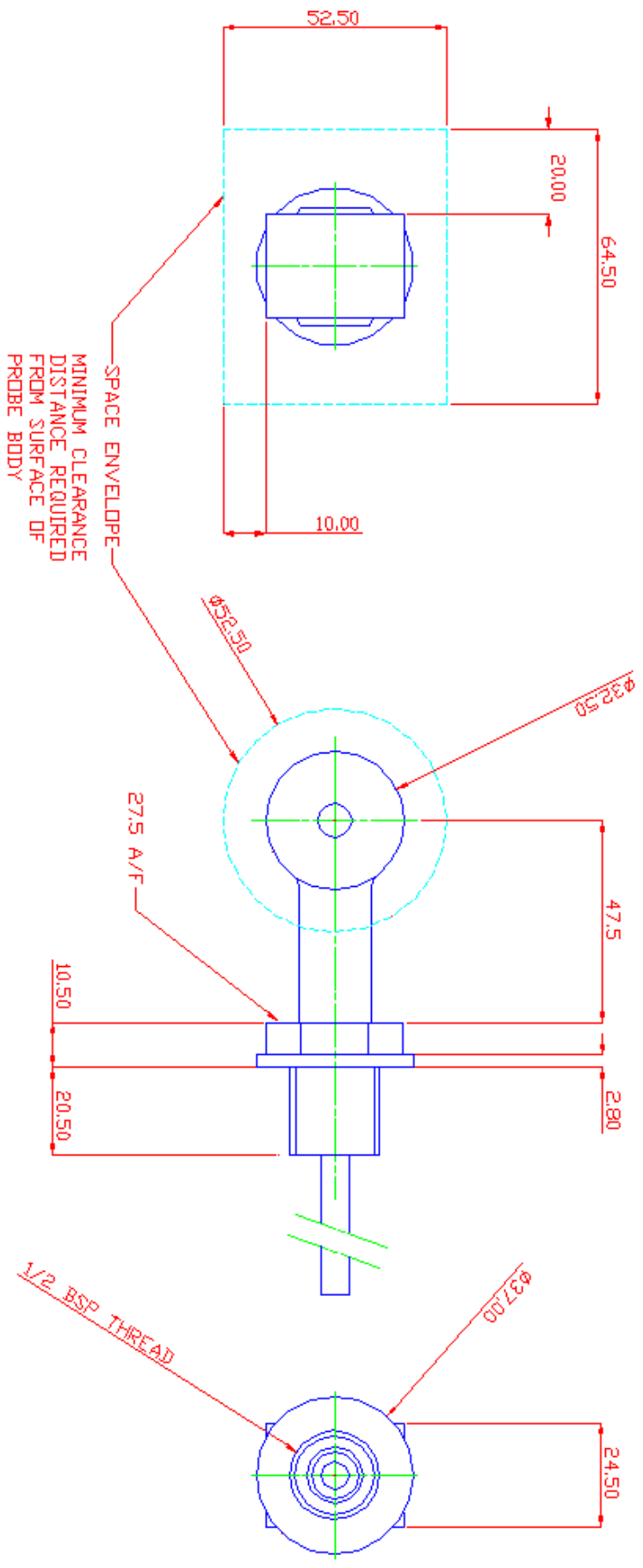
Mechanical mounting.

The probes can be fitted into tanks using a back nut and sealing washer or into the side of a 'T' piece inline with a pipe using an adaptor.

Note however that there needs to be a minimum clearance around the end of the probe as specified in the drawings below.

The probe should only be held during tightening using the hexagon on the body, on no account should the probe be tightened using the head or a bar through the hole in the head, this will damage the probe.

BKIN50 & BKEEX50
Dimensions



BEIN75 & BEEEX75
Dimensions

