



TEi 43i new SO2 FUNCTIONS (cRIO)

Auto detect based on sending command using Tei 43i SO2 ID - B5 (HEX).

Every second acquire SO2 concentration with 2 different monitoring parameters.

- 8 monitoring parameters in total so takes 4 seconds to acquire all monitoring parameters.

Mean Offset Calculation – starts 5 seconds after ev8 tuned on.

SO2 calibrated data = (SO2 concentration – offset) / slope

- Note: offset = mean offset or zero
- Note slope default = 1.1

SO2 Inflight MOCCA Alarm

- Check whether SO2 calibrated data exceed MOCCA SO2 limit
- If exceeded, check for MOCCA window delay time (30 seconds default)

10 minutes SO2 average calculation.

8 hour SO2 average calculation.

SO2 STEL and TWA concentration simulation.

Check whether 10 min SO2 average exceeds STEL limit.

Check whether 8 hour SO2 average exceeds TWA limit.

Read commands from user interface.

Set Mass Flow Controller 1 and receive parameters.

Set Mass Flow Controller 2 and receive parameters.

Calibration gas cylinder constant file – store on USB flash drive attached to cRIO u:\config\TEiSO2-43i_config.txt

In the event of network disconnection, watchdog shutdown on valves DO6, DO7 and DO4, set mass flow controller 2 to zero

UDP ASCII file store locally on USB flash drive attached to cRIO u:\data

UDP display packet to tanks

TCP binary file packet to tanks

TEi 43c old SO2 FUNCTIONS (cRIO)

Auto detect based on sending command using Tei 43i SO2 ID - AB (HEX).

Every second acquire SO2 concentration with 2 different monitoring parameters.

- 8 monitoring parameters in total so takes 4 seconds to acquire all monitoring parameters.

SO2 calibrated data = (SO2 concentration – offset) / slope

- Note: offset = mean offset or zero
- Note slope default = 1.1

10 minutes SO2 average calculation.

8 hours SO2 average calculation.

SO2 STEL and TWA concentration simulation.

Check whether 10 min SO2 average exceeds STEL limit.

Check whether 8 hour SO2 average exceeds TWA limit.

Read commands from user interface.

Set Mass Flow Controller 1 and receive parameters.

Set Mass Flow Controller 2 and receive parameters.

UDP ASCII file store locally on USB flash drive (u:\data) attached to cRIO.

UDP display packet to tanks.

TCP binary file packet to tanks.

TEi 43i new SO2 FUNCTIONS (User Interface)

Pre-flight functions:

- Calibration gas flushing - eV9 & MFC2 ON, flush time specified by user, then all off.
- Span gas calibration - eV9 & MFC2 ON, span gas flush time specified by user, eV8 ON, calibration time specified by user, then all off.
- Zero gas calibration - eV9 & MFC2 ON, zero gas flush time specified by user, eV8 ON, zeroing time specified by user, then all off.
- Ground zeroing –eV6 ON for user specified time, then all off.
- Enable auto zeroing

Inflight functions:

- Auto zero & zero calibration – eV9 & MFC2 ON, zero gas flush time specified by user, eV8 ON, zeroing time specified by user, then all off.
- Span calibration - eV9 & MFC2 ON, span gas flush time specified by user, eV8 ON, calibration time specified by user, then all off.
- SO2 zeroing (in-flight & ground) – eV6 ON for user specified time, then all off.
- Auto zeroing pause.
- Adjust auto zeroing interval (second).
- Abort zero and span calibration.

CO FUNCTIONS (cRIO)

Auto detect based on sending a command to CO on 38400 baud rate.

Every second acquire CO concentration and PMT raw count with 1 different monitoring parameters.

- 11 monitoring parameters in total so takes 11 seconds to acquire all monitoring parameters.

Send CO calibration command and detect whether “OK” received which indicates calibration completed.

Restart serial connection if ERR_22 is received from instrument.

Read commands from user interface.

UDP ASCII file store locally on USB flash drive (u:\data) attached to cRIO.

UDP display packet to tanks.

TCP binary file packet to tanks.

CO FUNCTIONS (user interface)

eV7 CO Vaccum control.

CO Calibration command.

CO Sensitivity and Zero values history display.

CO parameter values display.

Old FGGA FUNCTIONS (cRIO) 10Hz with Scroll Pump

Auto detect based on whether receiving data from FGGA on 9600 baud rate.

UDP broadcast for special FGGA Labview display client on 255.0.0.0 port 50005.

Read scroll pump monitoring parameters.

Read commands from user interface.

FGGA wet to dry calculation:

CH4 is scaled from ppm to ppb - 1 ppm = 10^3 ppb

CO2 remains at ppm

H2O is scaled from ppm to % - 1 ppm = $10^{-4}\%$

Output

CH4_Dry remains at ppb

CO2_Dry remains at ppm

$$X[\text{Dry}] = \frac{[X]\text{Wet}}{a + b [\text{H}_2\text{O}] + c [\text{H}_2\text{O}]^2}$$

CH4: a = 1.0006; b = -0.016697; c = -0.000533

CO2; a = 1.0001; b = -0.016889; c = -0.000444

FGGA dry to negative concentration if pressure less than 47.5 Torr.

Set Mass Flow Controller 1 and receive parameters.

In the event of network disconnection, watchdog to set flow depends whether high flow, low flow or flow off selected. Watchdog to disable ev1, ev2, ev3, ev4 and set MFC 1 to zero.

UDP ASCII file store locally on USB flash drive (u:\data) attached to cRIO.

UDP display packet to tanks.

TCP binary file packet to tanks.

New FGGA FUNCTIONS (cRIO) with Scroll Pump

Auto detect based on whether receiving data from FGGA on 57600 baud rate.

Read scroll pump monitoring parameters.

Read commands from user interface.

FGGA wet to dry calculation:

CH4 is scaled from ppm to ppb - 1 ppm = 10³ ppb

CO2 remains at ppm

H2O is scaled from ppm to % - 1 ppm = 10⁻⁴%

Output

CH4_Dry remains at ppb

CO2_Dry remains at ppm

$$X[\text{Dry}] = \frac{[X]\text{Wet}}{a + b [\text{H}_2\text{O}] + c [\text{H}_2\text{O}]^2}$$

CH4: a = 1.0006; b = -0.016697; c = -0.000533

CO2; a = 1.0001; b = -0.016889; c = -0.000444

FGGA dry to negative concentration if pressure less than 47.5 Torr.

Set Mass Flow Controller 1 and receive parameters.

In the event of network disconnection, watchdog to set flow depends whether high flow, low flow or flow off selected. Watchdog to disable ev1, ev2, ev3, ev4 and set MFC 1 to zero.

UDP ASCII file store locally on USB flash drive (u:\data) attached to cRIO.

UDP display packet to tanks.

TCP binary file packet to tanks.

New FGGA FUNCTIONS (user interface) with Scroll Pump

High flush – eV2, eV3, eV4, MFC1 ON flushing for 15 seconds, then all off.

Low flush – eV2, eV4 MFC1 ON flushing for 15 seconds, then all off.

Target flush – eV4 MFC1 ON flushing for 15 seconds, then all off.

High Calibration – eV2, eV3, eV4, MFC1 ON flushing for 45 seconds, plus eV1 ON calibration for 60 seconds, then all off.

Low Calibration - eV2, eV4, MFC1 ON flushing for 45 seconds, plus eV1 ON calibration for 60 seconds, then all off.

Target Calibration - eV4 & MFC1 ON flushing for 45 seconds, plus eV1 ON calibration for 60 seconds, then all off.

Span Calibration – High Calibration (as above), start CO calibration, Low Calibration (as above).

High to Low flow – eV10 OFF, wait for user specified period, eV12 OFF, wait for user specified period, eV11 ON, wait for user specified period, FGGA pump on.

Low to High flow – FGGA pump OFF, wait for user specified period, eV11 OFF, wait for user specified period, eV12 ON, wait for user specified period, eV10 ON.

High 140 Torr calibration - eV2, eV3, eV4, MFC1 ON flushing for user specified period, switch from high to low flow (as above), continue flushing for user specified period, plus eV1 ON calibration for user specified period, then all off, switch back to high flow (as above) if high flow selected.

Low 140 Torr calibration - eV2, eV4, MFC1 ON flushing for user specified period, switch from high to low flow (as above), continue flushing for user specified period, plus eV1 ON calibration for user specified period, then all off, switch back to high flow (as above) if high flow selected.

Target 140 Torr calibration - eV4, MFC1 ON flushing for user specified period, switch from high to low flow (as above), continue flushing for user specified period, plus eV1 ON calibration for user specified period, then all off, switch back to high flow (as above) if high flow selected.

Span 140 Torr calibration – High 140 Torr calibration (as above), start CO calibration, eV2, eV4 and MFC1 stays ON, eV1 & eV3 OFF, then start Low 140 Torr calibration (as above).

FGGA pump synchronize to Wait on Wheel flag (using port aft UDP packet).

Remote shutdown & restart old & new FGGA.

Transfer ASCII files to local machine and flight folder on flight manager laptop.

Auto restart STM communication with the Scroll pump server.

Check for Scroll pump fault.

FGGA scroll pump and parameters control.

TEi 49i new Ozone FUNCTIONS (cRIO)

Auto detect based on sending command using Tei 49i Ozone ID - BB (HEX).

Every second acquire O3 concentration with 2 different monitoring parameters.

- 8 monitoring parameters in total so takes 4 seconds to acquire all monitoring parameters.

Read commands from user interface.

In the event of network disconnection, watchdog shutdown on valves ev6.

UDP ASCII file store locally on USB flash drive attached to cRIO u:\data

UDP display packet to tanks.

TCP binary file packet to tanks.

TEi 49c old Ozone FUNCTIONS (cRIO)

Auto detect based on sending command using Tei 49c Ozone ID – B1 (HEX).

Every second acquire O3 concentration with 2 different monitoring parameters.

- 8 monitoring parameters in total so takes 4 seconds to acquire all monitoring parameters.

Read commands from user interface.

In the event of network disconnection, watchdog shutdown on valves ev6.

UDP ASCII file store locally on USB flash drive attached to cRIO u:\data

UDP display packet to tanks.

TCP binary file packet to tanks.

TEi 49c old & new Ozone FUNCTIONS (user interface)

- Ozone zeroing – eV6 ON for 10 minutes.

2B Ozone FUNCTIONS (cRIO)

Auto detect based on whether able to receive data on 19200 baud rate.

Read commands from user interface.

3 hour Ozone average calculation.

Instant ozone threshold (220) alarm check.

3 hour ozone threshold (80) alarm check.

Build packets based on whether ambient or cabin Ozone selected (default is ambient ozone)

UDP ASCII file store locally on USB flash drive attached to cRIO u:\data

UDP display packet to tanks.

TCP binary file packet to tanks.

General Monitoring FUNCTIONS (user interface)

Read UDP packets of FGGA, TEi SO₂, TEi Ozone, 2B Ozone and CO

Extract the relevant parameters from the UDP packet for local display.

Check network live connection with cRIO periodically every 2 seconds. Enable network disconnect flag when network disconnected.

Display USB flash drive usage.

Display total CPU load.

Display Mass Flow Meter value.

Display PTP time synch status.

General Monitoring FUNCTIONS (cRIO)

Enable disconnect watchdog flag when communication to user interface is lost.

Get USB flash drive usage.

Get total CPU load.

Get Mass Flow Meter value.

Get PTP time synch status.