
iqMAXREFDES42 Documentation

Release 1.2.0

IQ2 Development GmbH

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Introduction

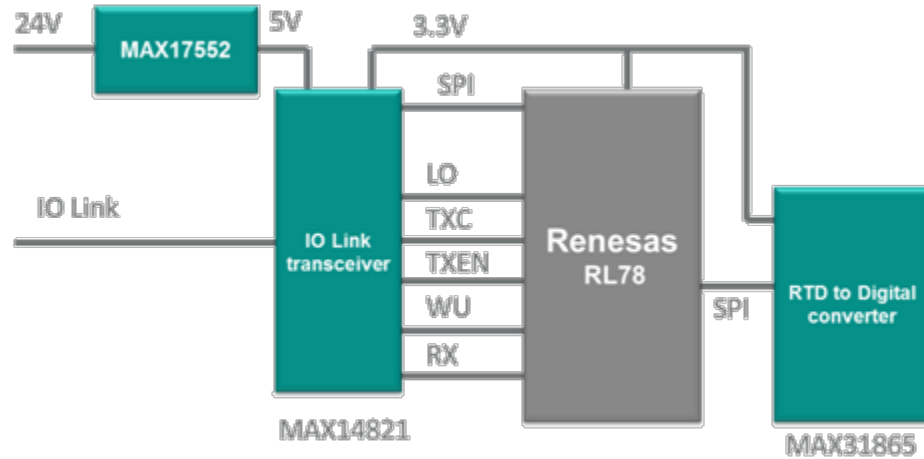


Maxim's Mojave (MAXREFDES42#) reference design features a resistance to digital temperature sensor which can also detect multiple faults. The IO-Link communication protocol enables quick sensor configuration and reduces cabling while featuring a robust, medium speed, communication protocol with power, enabling higher powered sensors than a 4-20mA loop.

1.1 Board Specification

| Item | Specification |
|---------------------------|--|
| Oscillator Frequency | 18.432MHz |
| Microcontroller | Renesas RL78/G1A (R5F10E8EALA) |
| DC Power | 24V via M12 Connector |
| LEDs | <ul style="list-style-type: none">• Power indicator: Green x1• IO-Link indicator: Amber x1• Digital output indicator: Red x1 |
| IO-link Connector | Male M12 4-pole A-coded |
| IO-Link PHY | Maxim MAX14821EWA+ |
| RTD-to-Digital Converter | MAX31865ATP+ |
| SPI 3.3V/5V Level Shifter | MAX1841EUB |
| Dot Addressable Display | SCE5744 Z |

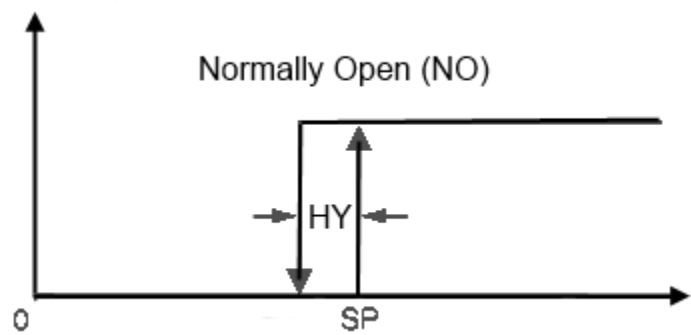
1.2 Project Goal



The purpose of this project is by giving the user a strong basis to start develop production-ready IO-Link® application based on Maxim Integrated IO-Link device transceiver ([MAX14821](#)), a Renesas ultra-low-power, 16-bit microcontroller (RL78) and [iqStack®](#) IO-Link Device Stack.

Sensor Logic

In iqMAXREFDES42 have been implemented simple switch-point hysteresis logic and additionally can be configured as normally open (NO) or normally closed (NC).



By default ambient temperature switch-point settings (32767 is the maximal value):

| What | SP (Level) | Hysteresis | Mode |
|---------------------|--------------------------|----------------------|--------------------|
| Ambient temperature | 9148 (0x23BC, 30°C/86°F) | 32 (0x20, 1°C/1.8°F) | Normally Open (NO) |

Note: Ambient temperature switch-point flag always indicated on digital output channel (red LED).

3.1 Process Data In

3.2 Process Data Out

3.3 Commands

| Value | Description |
|------------|---|
| 128 (0x80) | Device Reset |
| 160 (0xA0) | Tech-in ambient temperature switch-point level (see IO-Link index 0x0100 below) |

3.4 Parameters

| IO-Link index | Mode | Description | Default value |
|---------------|------------|--|--|
| 16 (0x0010) | read-only | Vendor Name | Maxim Integrated |
| 17 (0x0011) | read-only | Vendor Text | The world leader in analog integration |
| 18 (0x0012) | read-only | Product Name | Mojave (MAXREFDES42#) |
| 19 (0x0013) | read-only | Product ID | MAXREFDES42 |
| 20 (0x0014) | read-only | Product Text | IO-Link RTD Temp Sensor |
| 23 (0x0017) | read-only | Firmware Revision | v 1.2.0 |
| 256 (0x0100) | read/write | Ambient temperature switch-point level | 9148 (0x23BC, 30°C/86°F) |
| 257 (0x0101) | read/write | Ambient temperature switch-point hysteresis | 32 (0x20, 1°C/1.8°F) |
| 258 (0x0102) | read/write | Display's temperature scale (0 - °F, 1 - °C) | 1 (0x01) |
| 259 (0x0103) | read/write | N-wire type connection (2, 3, 4) | 2 |
| 260 (0x0104) | read/write | MAX31865ATP+ Configuration register | 0xCO (2-wire or 4-wire auto conversion mode) |
| 261 (0x0105) | read-only | MAX31865ATP+ RTD (2 bytes) | 0 |
| 262 (0x0106) | read/write | MAX31865ATP+ High Fault Threshold (2 bytes) | 0xFFFF |
| 263 (0x0107) | read/write | MAX31865ATP+ Low Fault Threshold (2 bytes) | 0 |
| 264 (0x0108) | read-only | MAX31865ATP+ Fault Status register | 0x00 |
| 265 (0x0109) | read/write | Reference resistance (3 bytes) | 400_000mΩ (PT100) |
| 266 (0x010A) | read/write | Nominal resistance at 0°C (3 bytes) | 100_000mΩ (PT100) |

3.5 Events

| Event code | Description |
|------------|----------------------------------|
| 0x4210 | Device temperature over-run |
| 0x5000 | Device hardware fault |
| 0x5111 | Primary supply voltage under-run |
| 0x6000 | Device software fault |
| 0x7710 | Short circuit |

Installation Details

There are two ways to experiment with MAXREFDES42#:

- Upload Firmware HEX-file, connect a device to IO-Link Master and play around.
- Clone the source code from Bitbucket repository, go throw and try to debug.

4.1 Firmware

Firmware HEX-file, IODDs data and this document in PDF format can be downloaded from the [Bitbucket repository](#) absolutely free without registration.

To upload HEX-file into MAXREFDES23 have to get [Renesas E1 emulator](#) and also [Renesas Flash Programmer](#).

4.2 Source Code

The project source code can be cloned from the [Bitbucket repository](#) freely without registration.

Download a trial version of [IAR RL78 Embedded Workbench IDE](#) in order to compile it and also take a look for [Renesas Application Leading Tool \(Applilet\)](#).

Also the [Renesas E1 emulator](#) and [Renesas Flash Programmer](#) needed to start debug session with a device.

Troubleshooting

If during power-on self-test (POST) hardware fails were occurred, then the main sensor application will not started and instead a first appeared hardware fail number was blinked on digital output red-indicator channel continuously and also was displayed on LCD.

| Blinks Count | Fail Description |
|--------------|--|
| 1 | Renesas RL78 Illegal memory access (a firmware error, contact with developers) |
| 2 | Renesas RL78 RAM parity check (a firmware error, contact with developers) |
| 3 | Renesas RL78 Illegal instruction (a firmware error, contact with developers) |
| 4 | Maxim MAX14821EWA+ selfcheck (the chip is possibly corrupt, try to restart the device) |
| 5 | Maxim MAX31865ATP+ selfcheck (the chip is possibly corrupt, try to restart the device) |

Changelog

6.1 v1.2 (2014-08-08)

- Improvements:
 - (#42) PT100 & PT1000 & Custom Ro

6.2 v1.1.1 (2014-07-28)

- Improvements:
 - (#4) Callendar-Van Dusen equation

6.3 v1.1 (2014-06-07)

- **Breaking changes:**
 - (#3) MAX31865ATP+ RTD-to-Digital Converter registers are available as IO-Link parameters
 - (#6) Switch N-wire connection type via an IO-Link parameter
- Improvements:
 - (#5) IODD picture and icon was added

6.4 v1.0 (2014-05-17)

- New features:
 - Hardware setups:
 - * Renesas RL78/G1A (R5F10E8EALA) microcontroller (with Applilet3 support, see 'src\applilet3_src')
 - * MAX14821EWA+ IO-Link Device Transceiver (SPI/UART, see 'src\hw_drivers\c_max1482x.*')
 - * MAX31865ATP+ RTD-to-Digital Converter (SPI, see 'src\hw_drivers\c_max31865.*')
 - * SCE574x 4-Character 5x7 Dot Matrix Serial Input Dot Addressable Display (SPI, see 'src\hw_drivers\c_sce574x.*')

- Porting IO-Link iqStack(R) Device and set up the IO-Link communication (see ‘src\applilet3_src\r_main.c’)
- Write a simple IO-Link *resistor temperature detector* Application (with appropriate IODDs, see ‘src\sensor_appl.c’)

Glossary

RTD Short for *resistor temperature detector*.

PV Short for *process value*.

resistor temperature detector Temperature sensor that operates on the measurement principle that a material's electrical resistance changes with temperature.

process value Internal unsigned numeric number, must be converted in order to display a required physical value.

License

All source files with the correspondent header notes are the subject to the IQ² Development GmbH terms and conditions defined in file `Allgemeine Vertragsbedingungen.pdf`.

For any other details please [contact with us](#).