

Overview

The MAXREFDES278# is a complete IO-Link® 8-Channel solenoid actuator reference design based on a [MAX22514](#) IO-Link transceiver with integrated protection. It demonstrates an 8-Channel solenoid actuator using the [MAX22200](#) 1A Octal Integrated Serial-Controlled Solenoid Driver with integrated FETs. This reference design has two power-options, it can be powered either through the IO-Link master directly, delivering up to 800mA total load, or for higher currents external power can be provided using an external source. To make sure no current flows back to the IO-Link master, and the IO-Link portion is always powered, this design uses the [MAX17608](#) current limiter with over voltage (OV), under voltage (UV), and reverse protection.

Built in an industrial form factor, and measuring just 85mm x 42mm, the MAXREFDES278# uses an industry-standard M12 connector, allowing a 4-wire IO-Link cable to be used. Each individual solenoid channel has its own 2-way terminal block.

Through the IO-Link interface, HIT and HOLD currents as well as times can be configured on a per-channel basis for the solenoid outputs. Diagnosis includes the open load faults, over current faults, and plunger movement indications.

In this design, a STM32 low-power microcontroller interfaces between the MAX22200 octal solenoid driver and the MAX22514 IO-Link device transceiver. The MAX22514 features integrated surge protection for robust communication in a small printed circuit board (PCB) area without requiring external protection components such as transient voltage suppressor (TVS) diodes. The MAX22514 is available in a tiny 25-bump wafer-level package (WLP) as well as a 24-pin TQFN package, allowing the MAXREFDES278# to have a small footprint. The design is reverse-polarity protected using the integrated active reverse-polarity protec-

tion of the MAX22514. The MAX22514 has an integrated DC-DC converter as well as two integrated low dropout (LDO) regulators (3.3V and 5.0V). The DC-DC converter is used to generate the 3.3V supply for the microcontroller as well as the MAX22200 logic supply, reducing power-dissipation as well as the number of external components required, saving space and cost. The MAX22514 also features a low on-resistance C/Q driver to reduce power dissipation, allowing this reference design to consume minimal power with very low thermal dissipation.

This IO-Link device utilizes the Technologie Management Gruppe Technologie und Engineering (TMG TE) IO-Link device stack to communicate to any IO-Link version 1.1-compliant master. The board contains a male M12 connector for connecting to a compliant IO-Link master using a standard M12 cable. Connecting the MAXREFDES278# to a USB IO-link master, such as the [MAXREFDES165#](#) or [MAXREFDES145#](#), with the associated software allows for easy evaluation.

Design files and software are available on the [Design Resources](#) tab. The board is also available for purchase. This document describes the hardware shown in [Figure 1](#).

Other features include the following:

- IEC 61131-9 Compliant
- TMG TE IO-Link Stack
- IO-Link Version 1.1 Compliant
- Octal Solenoid Driver

Applications

- Industrial Automation
- Actuator Modules
- PLC and DCS Systems
- Smart Actuators

Introduction

Advanced factory automation solutions (i.e., Industry 4.0) require an increasing number of smart sensors and actuators, which are typically controlled using IO-Link point-to-point serial communication between the sensor/actuator and controller (master). Maxim Integrated as a leading provider of IO-Link device transceiver and master transceiver ICs, also provides the complete reference design solutions to help its customers to improve their time to market. These proven designs cover all the hardware and software requirements needed for compliance with the IO-Link standard.

IO-Link is the first open, field bus agnostic, low-cost, point-to-point serial communication protocol used for communicating with sensors and actuators that has been

adopted as an international standard (IEC 61131-9). IO-Link finally standardizes interoperability of industrial equipment from all over the world. IO-Link can function directly from the PLC or be integrated into all standard field buses, quickly making it the de-facto standard for universally communicating with smart devices such as the MAXREFDES278#.

With this reference design, IO-Link allows the user to program and diagnose 8 individual solenoids. This enables industrial actuator equipment original equipment manufacturers (OEMs) to provide end users with total flexibility at the factory floor level to simplify equipment installation and commissioning, while reducing their number of SKUs and BOMs and simplifying and streamlining their purchasing and manufacturing.

Maxim Integrated and TMG TE collaborated to design the MAXREFDES278# reference design compliant with the IO-Link version 1.1/1.0 standard. The MAXREFDES278# design has an industry-standard MAX22514 IO-Link device transceiver, a low-power microcontroller that uses the TMG TE IO-Link device stack, and a MAX22200 octal solenoid driver that is fully software configurable. The complete reference design fits on an 85mm x 42mm PCB; the size is mostly dominated by the connectors. Components are placed on the top-side only, for lower assembly cost.

System Diagram

Figure 2 shows the MAXREFDES278# system block diagram.

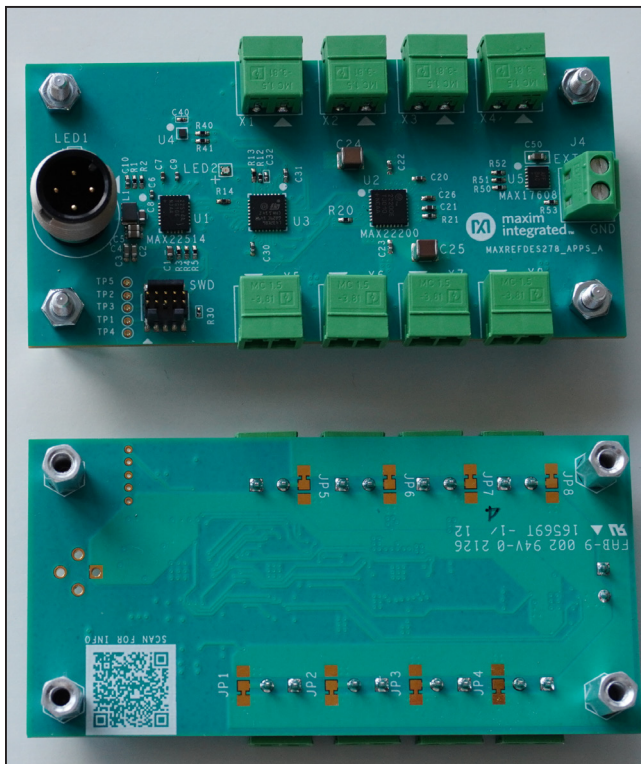


Figure 1. MAXREFDES278# IO-Link Octal Solenoid Driver.

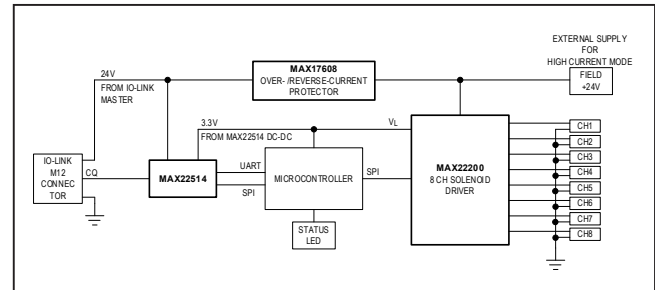


Figure 2. MAXREFDES278# system block diagram.

Detailed Description

Detailed Description of Hardware

The MAXREFDES278# IO-Link octal solenoid driver consumes minimal power, and space, making it a complete solution for many actuators found in various industrial control and automation applications.

The MAX22514 IO-Link device transceiver is compliant with the IO-Link version 1.1/1.0 physical-layer specification. It integrates the high-voltage functions commonly found in industrial sensors and actuators, including drivers, and two linear regulators. The MAX22514 features extensive integrated protection to ensure robust communication in harsh industrial environments. All three I/O pins (V24, C/Q, and GND) are reverse-voltage and short-circuit protected and feature integrated $\pm 1\text{kV}/500\Omega$ surge protection. This enables a very small PCB area with no required external protection components, such as TVS diodes. The low on-resistance driver (C/Q) further reduces power dissipation so that this reference design consumes minimal power with very low thermal dissipation. Operation is specified for normal 24V supply voltages up to 36V. Transient protection is simplified due to high voltage tolerance (i.e., 65V absolute maximum rating for the I/O pins without the integrated TVS diodes) in addition to the integrated surge protection.

The integrated DC-DC regulator in the MAX22514 generates the 3.3V supply for the microcontroller as well as the MAX22200, reducing the number of additional external components and the required space.

The MAX22514 features high configurability as well as diagnostics through an SPI interface and a 3-wire UART interface is provided for IO-Link communication.

The MAXREFDES278# does not require external protection devices such as varistors or TVS diodes due to the integrated surge protection in the MAX22514 at the IO-Link interface. This reference design meets both IEC 61000-4-2 for electrostatic discharge (ESD) up to $\pm 4\text{kV}$ and IEC 61000-4-4 for electrical fast transient (EFT) $\pm 4\text{kV}$ standards. The IO-Link side is designed to meet a surge capability (2A at $t = 1.2/50\mu\text{s}$) up to $\pm 1.0\text{kV}$.

The MAX22200 is an octal 36V serial-controlled solenoid driver. Each channel features a low impedance (200m Ω typ) push-pull output stage with sink-and-source driving capability and up to 1A_{RMS} driving current. A serial interface (SPI) that also supports daisy-chain configurations is provided to individually control each channel. The device half-bridges can be configured as low-side drivers or as high-side drivers. Moreover, pairs of half-bridges can be paralleled to double the driving current or can be configured as full-bridges to drive up to four latched valves (bi-stable valves) or four brushed DC motors. Two control methods are supported; voltage drive regulation (VDR)

and current drive regulation (CDR). In VDR, the device outputs a pulse-width modulation (PWM) voltage in which the duty cycle is programmed using SPI. For a given supply voltage and solenoid resistor, the output current is proportional to the programmed duty cycle. In CDR, an internal integrated lossless current sensing (ICS) circuit senses the output current and compares it with an internal programmable reference current.

For optimal power management in solenoid drive applications, the excitation drive level (I_{HIT}), the hold drive level (I_{HOLD}), and the excitation drive time (t_{HIT}) can be individually configured for each channel. The MAX22200 features a full set of protection and diagnostic functions. This includes overcurrent protection (OCP), thermal shutdown (TSD), undervoltage Lockout (UVLO), open-load detection (OL), and detection of plunger movement (DPM). A fault indication pin signals fault events and diagnostic information is stored in the FAULT register.

The MAX22200 is available in a compact 5mm x 5mm, 32-pin TQFN package and operates over the temperature -40°C to $+85^{\circ}\text{C}$ range.

The MAX17608 adjustable overvoltage and overcurrent protection device is ideal to protect systems against positive and negative input voltage faults up to +60V and -65V and features integrated low 260m Ω (typ) R_{ON} FETs. The adjustable input overvoltage protection range is 5.5V to 60V and the adjustable input undervoltage protection range is 4.5V to 59V. The input overvoltage-lockout (OVLO) and undervoltage-lockout (UVLO) thresholds are set using external resistors. Additionally, the devices offer an internal input undervoltage threshold at 4V (typ). The devices feature programmable current-limit protection up to 1A; hence, controlling the inrush current at startup while charging high capacitances at the output. The current-limit threshold is programmed by connecting a resistor from the SETI pin to GND. When the device current reaches the programmed threshold, the device prevents further increases in current by modulating the integrated FET resistance. The device can be programmed to behave in three different ways under current-limit conditions; Autoretry, Continuous, or Latch-off modes. The voltage appearing on the SETI pin is proportional to the instantaneous current flowing through the device and is read by an ADC. The MAX17608 blocks current flowing in the reverse direction (i.e., from OUT to IN) and features thermal shutdown protection against excessive power dissipation. It is available in a small, 12-pin (3mm x 3mm) TDFN-EP package and operates over the -40°C to $+125^{\circ}\text{C}$ extended temperature range.

For detailed information on the octal solenoid driver, IO-Link transceiver and the reverse and overcurrent protector, refer to the MAX22200, MAX22514 and MAX17608 data sheets.

Description of Firmware

The MAXREFDES278# ships preprogrammed as a working IO-Link device ready to connect to an IO-Link master. The firmware utilizes the TMG TE IO-Link device stack. After plug-in, the MAXREFDES278# waits for a wake-up signal from the IO-Link master. Once the wake-up signal is received, the MAXREFDES278# synchronizes to the IO-Link master using the 230.4kbps (COM3) baud rate, and communication parameters are exchanged. The IO-Link master then starts a cyclic data exchange by transferring the actuators process data. If the MAXREFDES278# is removed, the IO-Link master detects a missing device.

The MAXREFDES145 is an 8 port IO-Link Master utilizing the TE-Concept IO-Link Master Stack, the TE-Concept IO-Link Control Tool software is Windows®-compatible and features IODD file import capability, automatic download from IODD Finder, connects to a PC through USB, and is available to download from the Maxim website:

<https://www.maximintegrated.com/content/dam/files/secured/design-tools/software/6423/maxrefdes145-tc-installer-v3.9.7136.zip>

The TE-Concept IO-Link Control Tool software is shown in Figure 3, and a complete guide is also downloadable from the TE-Concept website.

The source code for the MAXREFDES278# is not available. The TMG TE IO-Link stack ships preprogrammed inside the MAXREFDES278# hardware with a perpetual license.

The TMG TE contact information is as follows:

Technologie Management Gruppe

Technologie und Engineering GmbH
Zur Giesserei 10
76227 Karlsruhe
Germany
Phone: +49 7218 28060
E-Mail: willems@tmgte.de
Internet: www.tmgte.com

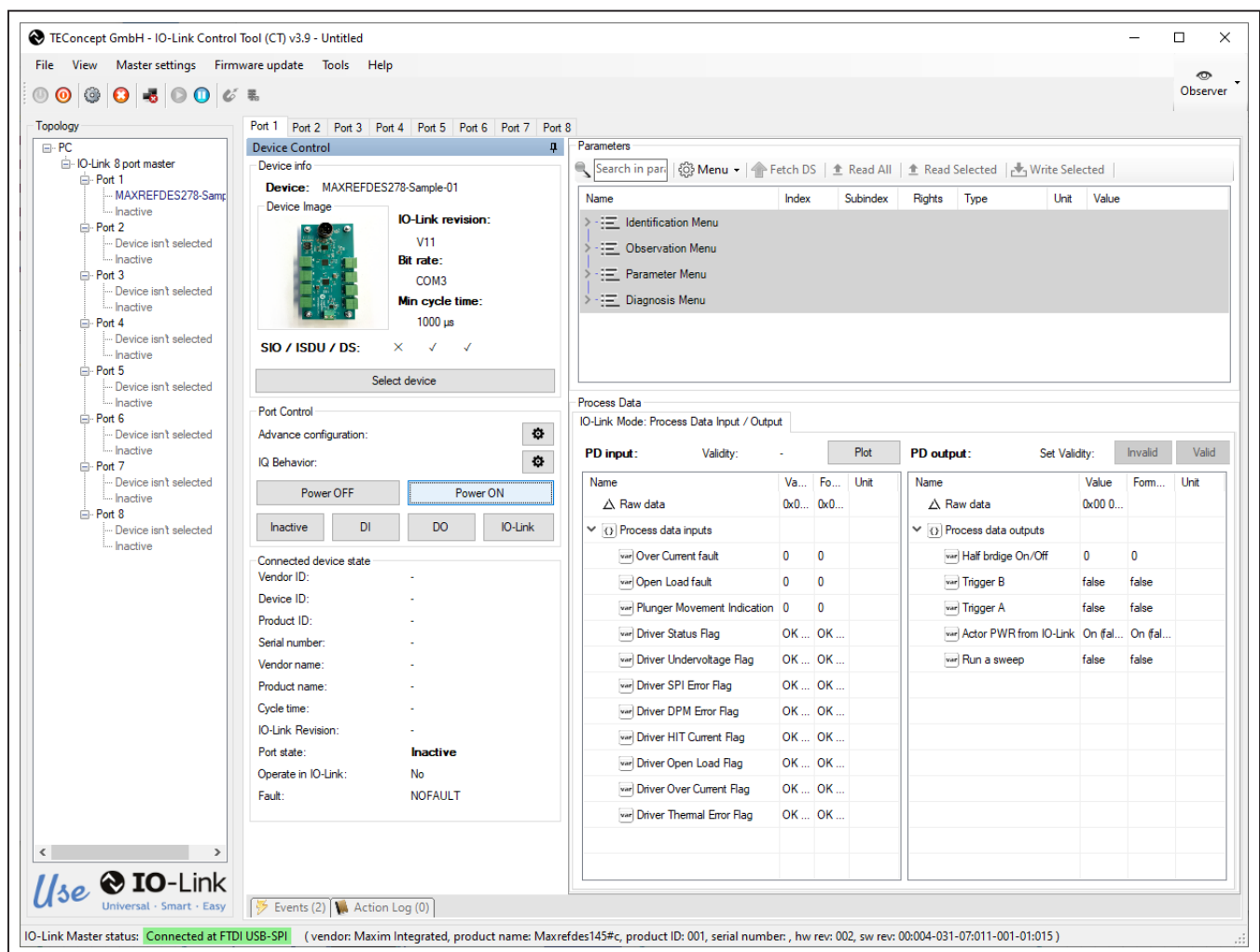


Figure 3. The TE-Concept IO-Link Control Tool.

Detailed Description of Software

The MAXREFDES278# was verified using the MAXREFDES145# IO-Link Master, featuring the MAX14819 IO-Link master transceiver and the IO-Link Control Tool from TE-Concept.

Download the IODD file (*.xml) located in the [Design Resources](#) tab and follow the step-by-step instructions in the [Quick Start Guide](#) section on how to use the software. [Figure 3](#) shows a screenshot of the TE-Concept IO-Link Control Tool communicating with the master and device.

EMC Testing

The general rules for the test configuration of a device (such as the MAXREFDES278#) are as follows:

- The SDCI cable should be unshielded, 20m long, coiled, and placed 10cm (4in) above the ground plane.
- The devices should be placed 10cm (4in) above the ground plane.

The MAXREFDES278# is tested in the Maxim Integrated lab for the common industrial compliance standards, and the test methodology and results are presented in this document. Although the IO-Link Interface and System Specification does not require surge testing, Maxim Integrated did this test in addition to the ESD and EFT tests.

Equipment Used

- MAXREFDES278# IO-Link Actuator
- MAXREFDES145# 8-Port IO-Link Master
- 20m M12 Cable
- Haefely® Technology ECOMPACT4 EFT/Surge Generator
- Teseq® CDN 117 Signal Line Coupling Network
- Teseq CDN 3425 EFT Data Line Coupling Clamp
- Teseq NSG438 ESD Generator

Surge Testing

The MAXREFDES278# module is tested to withstand up to $\pm 1.0\text{kV}$ of 1.2/50 μs IEC 61000-4-5 surge with a total source impedance of 500 Ω . The surge testing is performed using the MAXREFDES145# IO-Link master, and 10 surge pulses are applied for each test as shown in [Table 1](#).

While communicating with the master during the tests shown in [Table 1](#), the MAXREFDES278# continued to operate normally (execute code and transfer data) and is not damaged by the tests, and the MAX22514 registers are not corrupted.

EFT/Burst Testing

Using a 20m IO-Link cable with standard M12 connectors, the MAXREFDES278# is tested to withstand EFT/bursts up to $\pm 4\text{kV}$ according to the IEC 61000-4-4. The EFT testing is performed using the MAXREFDES145# IO-Link master, and EFT pulses are applied for one minute for each test, as shown in [Table 2](#).

ESD Testing

The MAXREFDES278# is tested to withstand ESD for Contact and Air-Gap Discharge up to $\pm 4\text{kV}$ according to the IEC 61000-4-2. The ESD testing is performed on the MAXREFDES278# M12 connector pins after the test operation is verified using the MAXREFDES145# IO-Link master to transfer data, as shown in [Table 3](#). The MAXREFDES278# is not damaged by any ESD tests and continued to operate normally.

Note: The IO-Link interface and system specification version 1.1.2 requires ESD testing with a 20m cable attached, and the ESD strike is applied to the device casing. Because this reference design is only a PCB with no metallic casing, the ESD strikes are applied to the male M12 connector pins. Maxim Integrated expects this design to meet the levels specified in [Table 3](#) when testing with a casing and cable.

Table 1. Surge Test Results for IO-Link Interface

TEST CONDITION	SURGE TESTS		
	L+ TO GND	C/Q TO GND	L+ TO CQ
+1kV	Pass	Pass	Pass
-1kV	Pass	Pass	Pass

Table 2. EFT/Burst Test Results

TEST CONDITION	5KHZ/15MS	100KHZ/0.75MS
+4kV	Pass	Pass
-4kV	Pass	Pass

Table 3. ESD Test Results

TEST CONDITION	L+ TO GND	C/Q TO GND
+4kV Contact Discharge	Pass	Pass
-4kV Contact Discharge	Pass	Pass
+4kV Air-Gap Discharge	Pass	Pass
-4kV Air-Gap Discharge	Pass	Pass

Restrictions and Warnings for Maxim Reference Design Use

The MAXREFDES278# is designed and tested to meet IO-Link operation and harsh industrial environments covered by the IEC 61000-4-x standards for transient immunity. This board and associated software are designed to be used to evaluate the performance of the MAX22514 and MAX22200 but are not intended to be deployed as-is into an end product in a factory automation system.

The MAXREFDES278# is not for use in functional safety or safety-critical systems.

Quick Start Guide

To test the MAXREFDES278#, connect it to a port of an IO-Link master. In the following example, a MAXREFDES145# IO-Link master and TE-Concept IO-Link Control Tool are used. However, any IO-Link compliant master and associated IO-Link device GUI should work.

Required Equipment

Supplied by Maxim

- MAXREFDES278#

Note: Download IODD files from the [Design Resources](#) tab.

User Supplied

- IO-Link master (i.e., MAXREFDES145#) with a 24V AC-to-DC power adapter
- TE-Concept IO-Link Control Tool software
- One IO-Link cable
- Windows PC with a USB port
- 24V Solenoid or Motor

Procedure

Master Setup Procedure

- 1) Connect the MAXREFDES278# actuator to the IO-Link master with an IO-Link M12 cable.
- 2) Connect the IO-Link master to the PC with a USB cable.

- 3) Download and install the latest IO-Link Control Tool software from the [Maxim Integrated](#) website.
- 4) Download the IODD file for the MAXREFDES278# either from the [Design Resources](#) tab or from the [IODD Finder](#) website.
- 5) The MAXREFDES278# comes preprogrammed with firmware and the IO-Link device stack.

MAXREFDES278 Testing Procedure

- 1) Connect the female end of the IO-Link cable to the MAXREFDES278#.
- 2) Connect the male end of the IO-Link cable to one of the ports on the IO-Link master.
- 3) Make sure that the MAXREFDES145 is powered with 24V supply and connected to the PC through a USB cable.
- 4) Open the IO-Link Control Tool software as shown in [Figure 4](#), and in the **FTDI USB-SPI Interfaces** area, click **refresh** button. The GUI automatically finds the IO-Link Master. Then click green **connect** button.

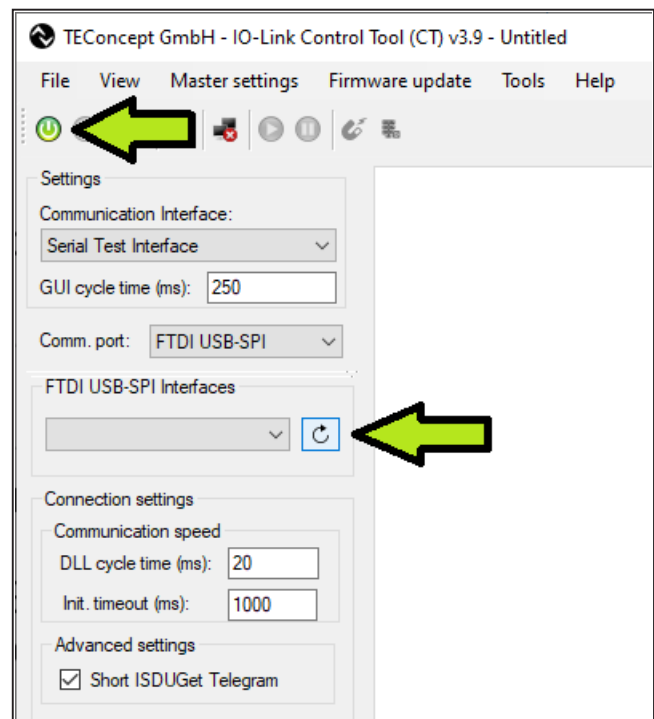


Figure 4. Connect and Refresh buttons in the IO-Link Control Tool software.

- 5) As shown in [Figure 5](#), import the IODD file for the MAXREFDES278#. The TE-Concept GUI also

allows to automatically download the IODD file from IODD Finder, by clicking **IODD Finder** in the **Select Device** menu.

The screenshot shows the TEConcept Device Selector GUI. The interface is divided into several sections:

- TEConcept** logo at the top left.
- Device variants** and **Languages** dropdown menus at the top right.
- Device basic data** section with fields for Vendor, Device, Vendor ID, Device ID, FW Upgrade, BLOB Transfer, and Description.
- IODD data** section with fields for IODD, Release date, and Document version.
- IO-Link data** section with fields for Bitrate, IO-Link version, MinCycle time, and SIO mode.
- IO-Link Devices** section on the right, showing a list of devices (Maxim Integrated Products, Inc. and TMG TE GmbH) and buttons for IODD Finder, Import, Delete, Exit, and Select device.

Two green arrows point to the **IODD Finder** and **Import** buttons in the IO-Link Devices section.

Figure 5. Device Selector.

- 6) As shown in Figure 6, in the **Topology** area, in the **Device Tree**, select the Port where the MAXREF-DES278# is connected to.
- 7) Click **Power ON** button, this enables the L+ supply for the selected Port. The power-led on MAXREF-

DES278# as well as the red L+ LED on the selected MAXREFDES145# Port should now be on.

- 8) Then, click the **IO-Link** button.

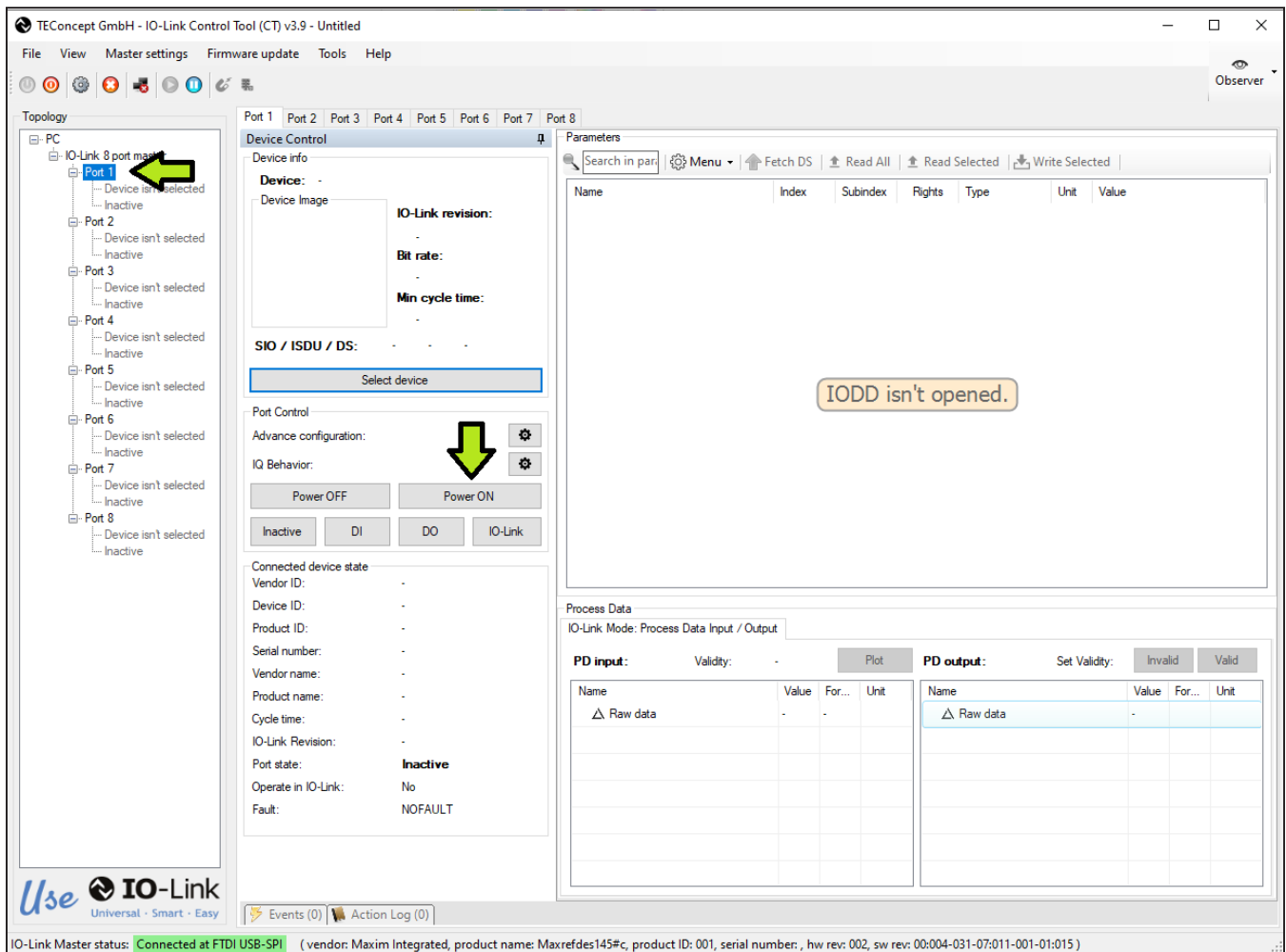


Figure 6. Port selections in the IO-Link Control Tool software.

- 9) If communication is established correctly as shown in Figure 7, the IO-Link Control Tool software shows the Vendor ID, Device ID, Cycle time, as well as the Process Data input (PD input). Next to the PD input it should show **Validity: valid** in green. This means the Master is successfully communicating with the IO-Link Device.
- 10) Observe that under Process data inputs all diagnostic shows “0” or “OK”.
 - a) Over Current fault is an 8-bit value, each individual bit flags the status of the appropriate channel.
 - b) Overload fault is an 8-bit value, each individual bit flags the status of the appropriate channel.
 - c) Plunger Movement Indication is an 8-bit value, each individual bit flags the status of the appropriate channel.
 - d) Driver Status Flag shows the status of the MAX22200 octal driver.
 - e) Driver Undervoltage Flag shows if the MAX22200 faces an undervoltage condition.
 - f) Driver SPI Error Flag shows if the MAX22200 has SPI communication errors.
 - g) Driver DPM Flag shows if there was a Plunger fault on any channel of the MAX22200.
 - h) Driver HIT Flag shows if the HIT current isn't reached on any channel of the MAX22200.
 - i) Driver Open Load Flag shows if there is an Open Load condition on any channel of the MAX22200.
 - j) Driver Over Current Flag shows if there is an overcurrent condition on any channel of the MAX22200.
 - k) Driver Thermal Error Flag shows if the MAX22200 is in thermal shutdown.

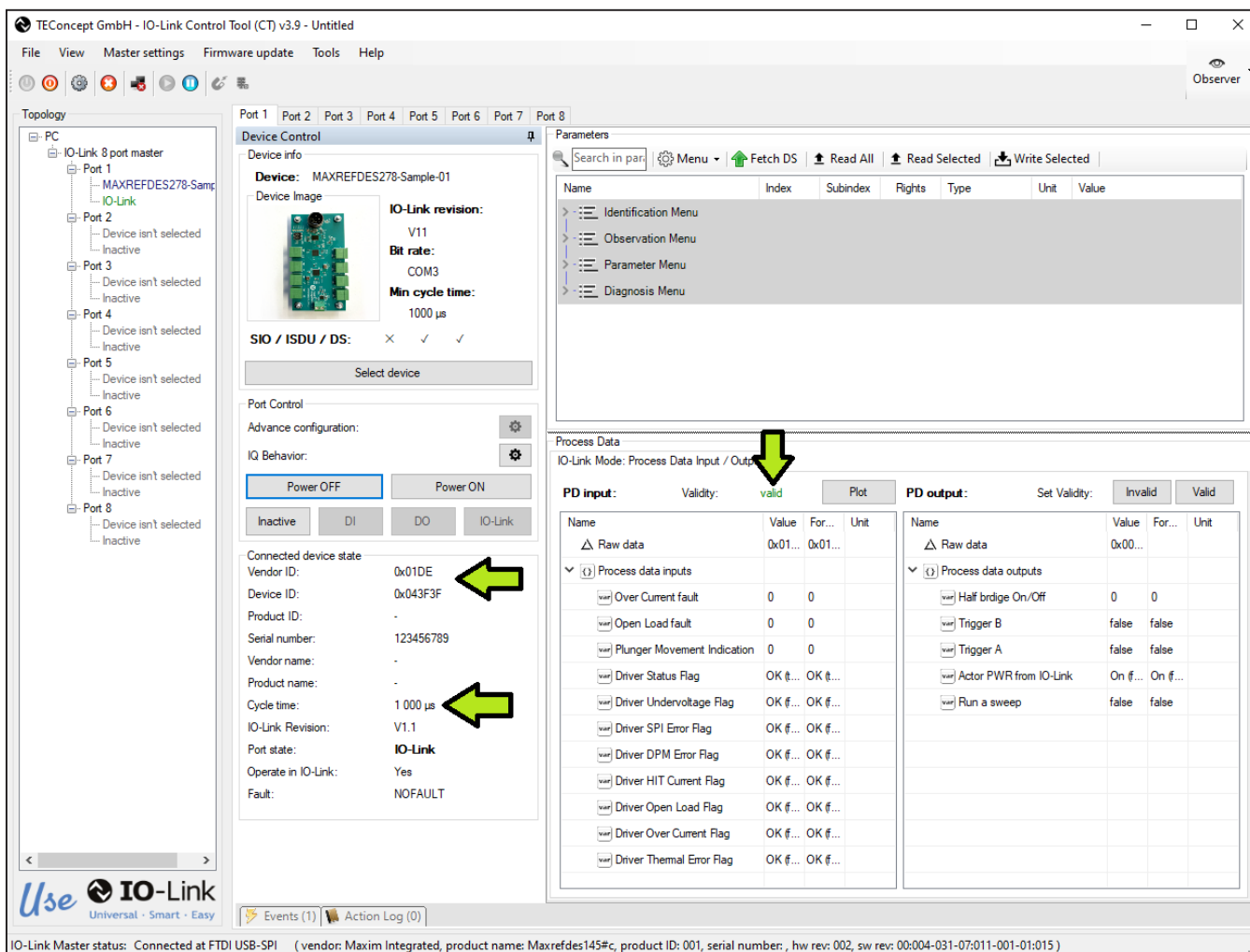


Figure 7. Successfully communication established in the IO-Link Control Tool software.

11) Details about above status information as well as adjustments can be made in the **Parameter** menu in the top right part of the Port window as shown in [Figure 8](#).

12) Click little arrow to the right of the **Parameter** Menu, then click little arrow on the **Device Parameterization (Bit access)**. This opens a menu that allows access to all Status as well as configurations of the MAX22200.

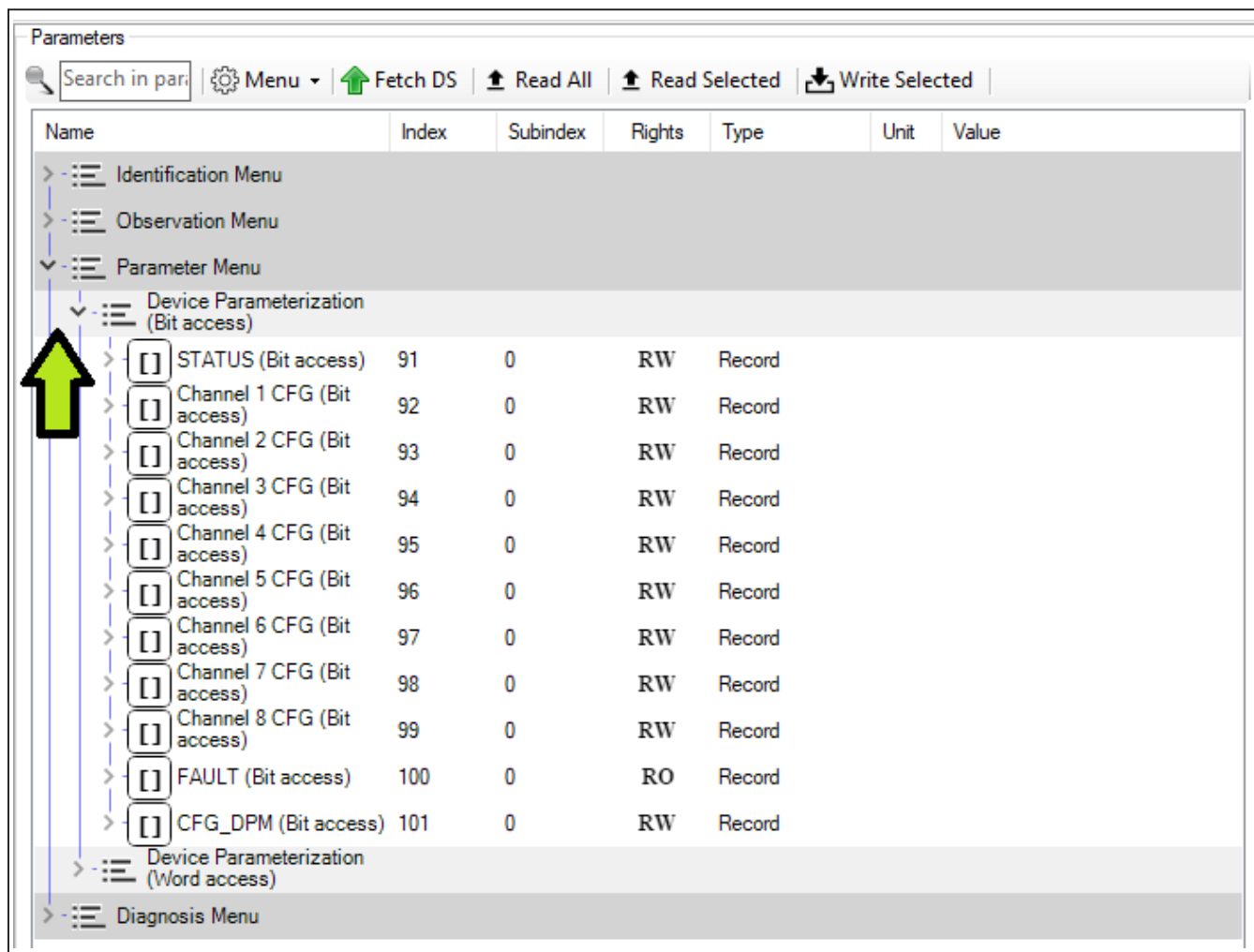
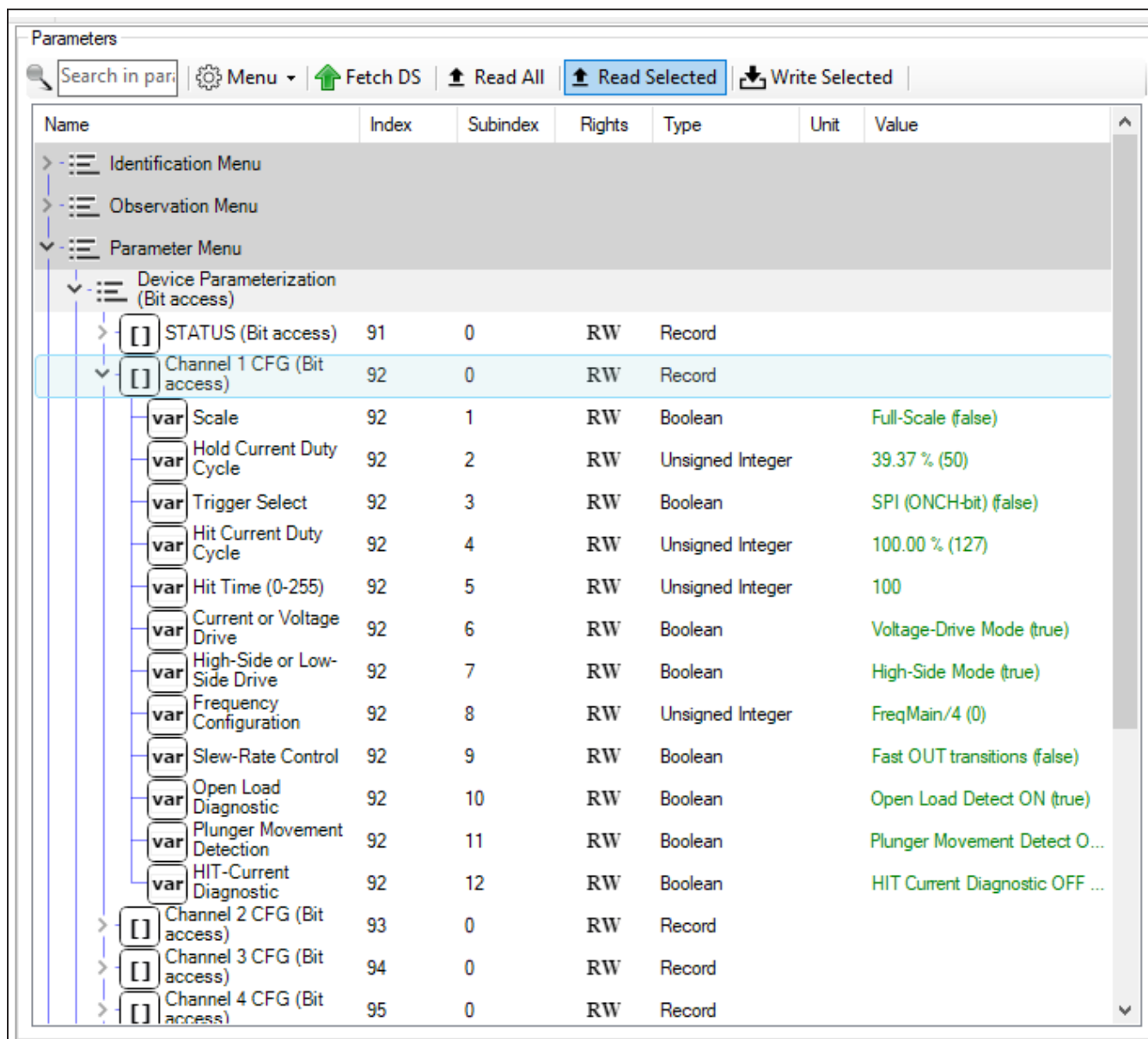


Figure 8. Device Parameterization (Bit access) menu.

- 13) As shown in Figure 9, open **Channel 1 CFG (Bit access)** menu, then click **Channel 1 CFG (Bit access)** to make sure it's highlighted. Then click **Read Selected**, this reads the current settings of Channel 1.



The screenshot shows a software interface titled "Parameters" with a search bar and several action buttons: "Menu", "Fetch DS", "Read All", "Read Selected" (highlighted), and "Write Selected". Below these is a table of parameters organized into a tree structure. The "Parameter Menu" is expanded, showing "Device Parameterization (Bit access)". Under this, "Channel 1 CFG (Bit access)" is selected and highlighted in blue. The table lists various configuration parameters for Channel 1, including Scale, Hold Current Duty Cycle, Trigger Select, Hit Current Duty Cycle, Hit Time, Current or Voltage Drive, High-Side or Low-Side Drive, Frequency Configuration, Slew-Rate Control, Open Load Diagnostic, Plunger Movement Detection, and HIT-Current Diagnostic. Each parameter has a name, index, subindex, rights, type, and a value.

Name	Index	Subindex	Rights	Type	Unit	Value
> Identification Menu						
> Observation Menu						
> Parameter Menu						
> Device Parameterization (Bit access)						
> STATUS (Bit access)	91	0	RW	Record		
> Channel 1 CFG (Bit access)	92	0	RW	Record		
var Scale	92	1	RW	Boolean		Full-Scale (false)
var Hold Current Duty Cycle	92	2	RW	Unsigned Integer		39.37 % (50)
var Trigger Select	92	3	RW	Boolean		SPI (ONCH-bit) (false)
var Hit Current Duty Cycle	92	4	RW	Unsigned Integer		100.00 % (127)
var Hit Time (0-255)	92	5	RW	Unsigned Integer		100
var Current or Voltage Drive	92	6	RW	Boolean		Voltage-Drive Mode (true)
var High-Side or Low-Side Drive	92	7	RW	Boolean		High-Side Mode (true)
var Frequency Configuration	92	8	RW	Unsigned Integer		FreqMain/4 (0)
var Slew-Rate Control	92	9	RW	Boolean		Fast OUT transitions (false)
var Open Load Diagnostic	92	10	RW	Boolean		Open Load Detect ON (true)
var Plunger Movement Detection	92	11	RW	Boolean		Plunger Movement Detect O...
var HIT-Current Diagnostic	92	12	RW	Boolean		HIT Current Diagnostic OFF ...
> Channel 2 CFG (Bit access)	93	0	RW	Record		
> Channel 3 CFG (Bit access)	94	0	RW	Record		
> Channel 4 CFG (Bit access)	95	0	RW	Record		

Figure 9. Channel 1 CFG (Bit access) menu.

- 14) Select the Scale, Hit, and Hold currents in percent as well as timing parameters.
For detailed information about these settings, refer to the [MAX22200 datasheet](#). Detailed status can

be read under the **STATUS (Bit access)** menu as shown in [Figure 10](#).

- 15) For detailed Status and global Configuration of the MAX22200, refer to the **STATUS** section.

Name	Index	Subindex	Rights	Type	Unit	Value
Device Parameterization (Bit access)						
STATUS (Bit access)	91	0	RW	Record		
var OVT Fault Mask	91	2	RW	Boolean		OVT Faults Enabled (false)
var OCP Fault Mask	91	3	RW	Boolean		OCP Faults Enabled (false)
var OLF Fault Mask	91	4	RW	Boolean		OLF Faults Enabled (false)
var HHF Fault Mask	91	5	RW	Boolean		HHF Faults Enabled (false)
var DPM Fault Mask	91	6	RW	Boolean		DPM Faults Enabled (false)
var COM Fault Mask	91	7	RW	Boolean		COM Faults Enabled (false)
var Undervoltage Fault Mask	91	8	RW	Boolean		Undervoltage Faults Enable...
var Internal Oscillator Frequency setting	91	9	RW	Boolean		100kHz (false)
var Channel 1 / 2 Config	91	10	RW	Unsigned Integer		0: Independent Mode (0)
var Channel 3 / 4 Config	91	11	RW	Unsigned Integer		0: Independent Mode (0)
var Channel 5 / 6 Config	91	12	RW	Unsigned Integer		0: Independent Mode (0)
var Channel 7 / 8 Config	91	13	RW	Unsigned Integer		0: Independent Mode (0)
var Thermal Error Flag	91	14	RW	Boolean		Normal Operation (false)
var OverCurrent Error Flag	91	15	RW	Boolean		Normal Operation (false)
var OpenLoad Error Flag	91	16	RW	Boolean		Normal Operation (false)
var HIT-Current Error Flag	91	17	RW	Boolean		Normal Operation (false)
var Plunger Error Flag	91	18	RW	Boolean		Normal Operation (false)
var Communication Error Flag	91	19	RW	Boolean		Normal Operation (false)
var Undervoltage Error Flag	91	20	RW	Boolean		Normal Operation (false)
var Active Bit	91	21	RW	Boolean		Normal Operation (true)
Channel 1 CFG (Bit	92	0	RW	Record		

Figure 10. Status (Bit access) menu.

- 16) Detailed per Channel Faults can be read under the **FAULT (Bit access)** menu as shown in [Figure 11](#).
- 17) Individual channels can be driven by setting a bit in the Process Data output-> Half-bridge On/Off byte. Each bit drives an individual channel.
Bit 0 stands for Channel 1
- to drive Channel 1, set Half bridge On/Off to 1.
 - to drive Channel 2, set it to 2
 - to drive Channel 3, set it to 4.
 - to drive Channel 1 and 3, set it to 5.
- 18) Groups can also be built and then driven by the Trigger A or Trigger B bits.
To enable this feature the Trigger Select bit must be set in the individual Channel Configuration.
- 19) If an external 24V supply is provided for the solenoids, the 24V supply from IO-Link can be disabled by setting the "Actor PWR from IO-Link" bit in the Process Data Output.

Parameters							
Search in parameters Menu Fetch DS Read All Read Selected Write Selected							
Name	Index	Subindex	Rights	Type	Unit	Value	
▼ ☐ FAULT (Bit access)	100	0	RO	Record			
☐ var CH1 Overcurrent Bit	100	1	RO	Boolean		CH1 Normal Operation (	
☐ var CH2 Overcurrent Bit	100	2	RO	Boolean		CH2 Normal Operation (	
☐ var CH3 Overcurrent Bit	100	3	RO	Boolean		CH3 Normal Operation (	
☐ var CH4 Overcurrent Bit	100	4	RO	Boolean		CH4 Normal Operation (	
☐ var CH5 Overcurrent Bit	100	5	RO	Boolean		CH5 Normal Operation (	
☐ var CH6 Overcurrent Bit	100	6	RO	Boolean		CH6 Normal Operation (	
☐ var CH7 Overcurrent Bit	100	7	RO	Boolean		CH7 Normal Operation (	
☐ var CH8 Overcurrent Bit	100	8	RO	Boolean		CH8 Normal Operation (	
☐ var CH1 HIT Current not reached Bit	100	9	RO	Boolean		CH1 Normal Operation (	
☐ var CH2 HIT Current not reached Bit	100	10	RO	Boolean		CH2 Normal Operation (	
☐ var CH3 HIT Current not reached Bit	100	11	RO	Boolean		CH3 Normal Operation (	
☐ var CH4 HIT Current not reached Bit	100	12	RO	Boolean		CH4 Normal Operation (	
☐ var CH5 HIT Current not reached Bit	100	13	RO	Boolean		CH5 Normal Operation (	
☐ var CH6 HIT Current not reached Bit	100	14	RO	Boolean		CH6 Normal Operation (	
☐ var CH7 HIT Current not reached Bit	100	15	RO	Boolean		CH7 Normal Operation (	
☐ var CH8 HIT Current not reached Bit	100	16	RO	Boolean		CH8 Normal Operation (	
☐ var CH1 Open Load Fault Bit	100	17	RO	Boolean		CH1 Normal Operation (	
☐ var CH2 Open Load Fault Bit	100	18	RO	Boolean		CH2 Normal Operation (	
☐ var CH3 Open Load Fault Bit	100	19	RO	Boolean		CH3 Normal Operation (	
☐ var CH4 Open Load Fault Bit	100	20	RO	Boolean		CH4 Normal Operation (	
☐ var CH5 Open Load Fault Bit	100	21	RO	Boolean		CH5 Normal Operation (	
☐ var CH6 Open Load Fault Bit	100	22	RO	Boolean		CH6 Normal Operation (	

Figure 11. FAULT (Bit access) menu.

Trademarks

STM32 is a registered trademark and registered service mark of STMicroelectronics International N.V.

Haefely is a registered trademark of Haefely Test AG.

IO-Link is a registered trademark of Profibus User Organization (PNO).

Maxim is a registered trademark of Maxim Integrated Products, Inc.

Teseq is a registered trademark of Ametek CTS.

Windows is a registered trademark of Microsoft Corporation.

Design Resources

Download the complete set of [Design Resources](#) including schematics, bill of materials, and PCB layout.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	12/21	Initial release	—

