Features

- **STM32F746ZGT7** high-performance MCU embedding ARM® 32-bit Cortex®-M7 CPU with FPU, Chrom-ART accelerator, and DSP instructions
- **CLT01-38SQ7** octal high-speed digital input current limiter with SPI interface
- **CLT03-2Q3** dual-channel self-powered digital input current limiter
- **ISO8200AQ** galvanic isolated octal high-side smart power solid-state relay with SPI interface
- **IPS4260L** quad low-side intelligent power switch
- Main supply voltage: 18 - 32 V (24 V nominal)
- **STSW-PLC001** firmware package
- 3.5'' TFT display with multitouch capability interfaced through dedicated parallel, digital RGB ports and PC lines
- **STLD40DPUR**-based display back-light LED driver with controllable intensity
- Morpho connectors for expansion connectivity options
- Screw connectors for safer power supply and industrial IO connections
- USB connector for alternate 5 V source power supply (only for display powering and MCU programming/debug)
- Isolated USART port connector
- SWD connector for debugging and programming
- Status LEDs for inputs, outputs, and various fault conditions
- Debug LEDs
- Reset button
- Protections against surge, EMI, and input reverse voltage connection
- EMC pad and four-layer routing
- On-board RAM and serial Flash (ROM)
- Provision for RTC, USB (with one or more additional components to be mounted)
- Designed to meet IEC industrial standard requirements
- RoHS

Description

The **STEVAL-PLC001V1** evaluation board targets compact programmable logic controller (PLC) applications in the factory automation domain. It features a powerful human machine interface (HMI) thanks to the 3.5'' TFT touchscreen mounted on the PCB, which eases interaction with the tool.

The board implements a galvanically isolated PLC control unit with robust digital input, digital output modules, expansion connectivity options, and interfaces.

The control unit consists of a powerful 144-pin STM32F746ZGT7 MCU, which handles the industrial IOs on one side and the TouchGFX display technology on the other side, implementing the ladder logic programming code and several additional options.
Highly robust and reliable industrial digital input and output modules are placed symmetrically on the PCB, making the system a 12+12 PLC, that is, a PLC GUI optimized for STM32 microcontrollers, which manages 12 industrial inputs and 12 industrial outputs.

The 12 industrial inputs have been implemented through the combination of an eight-channel CLT01-38SQ7 and two dual channel CLT03-2Q3 ICs.

The CLT01-38SQ7 features 6.25 MHz SPI with daisy chain capability to connect, in this case, the eight-channel output ISO8200AQ and reverse polarity, whereas the CLT03-2Q3 features two high- and low-side compatible independent channels, which can be powered from the external sensors they interface with, and the capability of running in the 60 V range for fail-safe applications.

The 12 industrial output array consists of an eight-channel ISO8200AQ IC and a four-channel IPS4260L low-side intelligent power switch.

The ISO8200AQ offers a daisy-chain SPI interface and embedded galvanic insulation, separating logic and power side of 4 kV and making the solution cost-effective (no opto-coupler is needed).

The STEVAL-PLC001V1 also features connectivity options typical of commercial PLCs through the morpho connectors mounted on the PCB bottom, ensuring compatibility with STM32 Nucleo expansion boards.

The embedded ICs for industrial IO management allow great flexibility in terms of technical features, protections and embedded diagnostics, when interfacing industrial range inputs (that is, sensors and valves) and outputs (that is, lamps, alarms, and actuators) with the logic side.

The STSW-PLC001 companion software package, freely available on www.st.com, allows experimenting with these advanced features and their combination.

Thanks to this software and the smart user interface offered by the TouchGFX, you can learn how the ICs work and exploit ready-to-use examples as well as ladder logic demonstrations and projects.
1 Solution overview

The following block diagram shows the STEVAL-PLC001V1 architecture.

The main blocks are:
- the STM32F746ZG7 microcontroller;
- twelve industrial inputs managed through the eight-channel CLT01-38SQ7 and the dual channel CLT03-2Q3 mounted twice;
- twelve industrial outputs on the bottom handled by other two dedicated ICs: the eight-channel ISO8200AQ and the four-channel IPS4260L.

The architecture also includes a 3.5" TFT display powered by the TouchGFX graphics engine for great flexibility in industrial IO management, giving abstraction from the hardware on one side, and full featured use of the ICs on the other side.

The morpho connectors allow connecting expansion boards and the USB connector allows supplying the board in case a 24 V power supply is not available.

Note: When powered through the USB port, the STEVAL-PLC001V1 has limited functionalities, as it works in demo mode, allowing display management and programming features but not high current rates on the industrial IOs.

A screw connector in the bottom-left corner is provided to power the board. All other isolated and logic supply voltages derive from this 24 V input after appropriate conditioning.

A P-channel MOSFET ensures reverse polarity protection, while other ICs are for EMI and surge protections.

A screw connector in the bottom-right corner powers field side devices.
Figure 2. STEVAL-PLC001V1 circuit schematic (1 of 9)

Schematic diagrams
Figure 3. STEVAL-PLC001V1 circuit schematic (2 of 9)
Figure 4. STEVAL-PLC001V1 circuit schematic (3 of 9)

CLT03-2Q3

Isolation Barrier

R23, R24, R25, R26
Can be replaced by a capacitor for test purpose

INPUT

High/Low Digital Inputs

Either High (I1.xH) or Low (I1.xL) side-in-out can be selected. Corresponding Low or High terminal to be connected accordingly.

J6

24V_Field

CON6-2315

CON6-2315

DB4542

-Rev 1

page 6/15

STEVAL-PLC001V1 Schematic diagrams
Figure 7. STEVAL-PLC001V1 circuit schematic (6 of 9)
Figure 9. STEVAL-PLC001V1 circuit schematic (8 of 9)
### 3 Board versions

#### Table 1. STEVAL-PLC001V1 versions

<table>
<thead>
<tr>
<th>Finished good</th>
<th>Schematic diagrams</th>
<th>Bill of materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEVAL$PLC001V1A (1)</td>
<td>STEVAL$PLC001V1A schematic diagrams</td>
<td>STEVAL$PLC001V1A bill of materials</td>
</tr>
</tbody>
</table>

1. *This code identifies the STEVAL-PLC001V1 evaluation board first version.*
Revision history

Table 2. Document revision history

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<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Changes</th>
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</thead>
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<tr>
<td>25-Oct-2021</td>
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<td>Initial release.</td>
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