UM0526
User manual

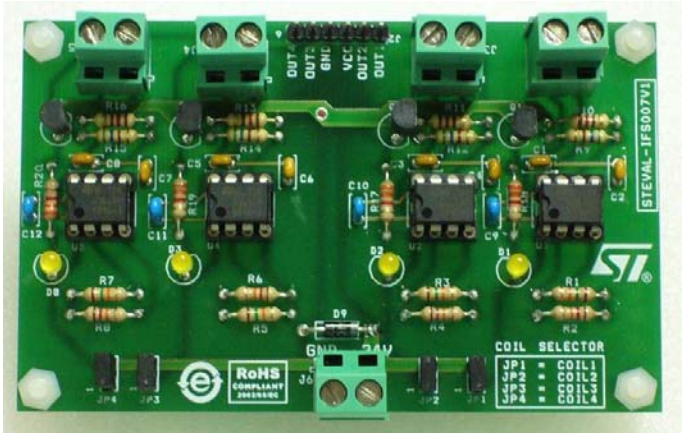
STEVAL-IFS007V1 4-channel proximity sensor board based on TDA0161

Introduction

This user manual explains the STEVAL-IFS007VA which has been designed to be easy to plug into 24 V operated systems as it is usually implemented in factory automation environments.

The document shows the STEVAL-IFS007V1 demonstration kit (hereafter also called “proxy board”) features, its technical characteristics and then, as an optional feature, the connectivity to the CLT3-4BT6 board (a board hosting a current-limited overvoltage-protected quad digital termination). Finally, a detailed illustration of an application example is also given. The STEVAL-IFS007V1 can be considered a system end-board. It could be placed as a standalone in systems where no processing or control characteristics are required or it could be integrated as an end board in control systems, in which case an interface board like the CLT3-4BT6 previously mentioned is necessary to protect the microcontroller and other application specific devices from high current and voltages out of their specifications. When the board is used as a standalone, it is possible to connect up to 4 different and independent coils. Each coil acts as the passive element able to sense an incoming metallic object by sensing variations in high frequency eddy current losses. The TDA0161 proximity detector changes its output signal as a consequence of a supply current change. In fact, independently of the supply voltage provided, this current is high (or low) according to the presence (or absence) of a closely located metallic object, consequently the output voltage level corresponding to that channel changes coherently. In terms of output voltage, the variation is between ~8.5 V and 11.5 V in a 24 V supplied system, so the output span is about 3 V. On-board jumpers are placed in order to enable/disable channels. Also on-board LEDs are placed to furnish a local alert when an object is close to a coil. At this end, the circuit parameters are tuned in order to detect metallic objects at a distance up to 4 mm. For further details on parameter tuning and on the circuit and device functionality, please refer to the TDA0161 device datasheet.

Figure 1. The STEVAL-IFS007V1 board



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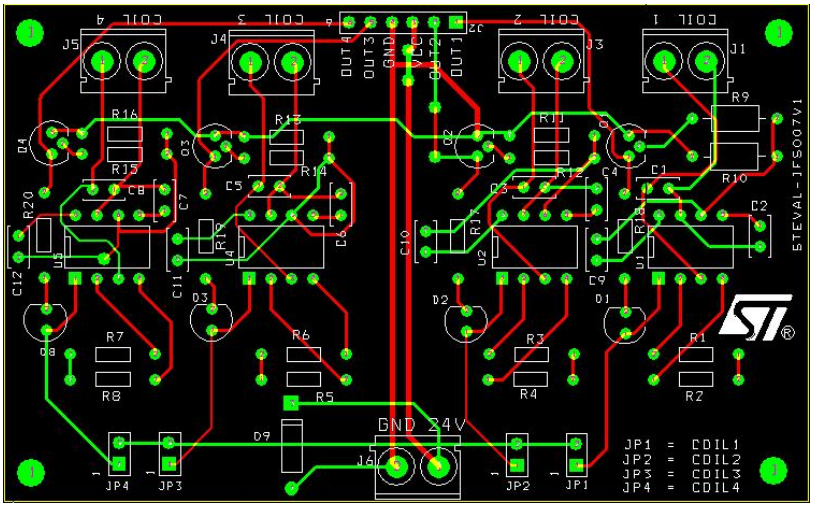
1 The proxy board

This board could be considered the end board of control systems commonly used in factory automation environments. The board also offers a connector that allows interfacing it with other 24 V supplied systems or systems like the CLT3-4BT6 board for IO protection in order to connect it to control boards typically running at 3.3 V or 5 V. A plaque for mounting the sensing element at distances up to 2 m (look forward for details) can be taken into consideration in systems using the STEVAL-IFS007V1. The main features are as follows:

- Four TDA0161 proximity detectors, able to detect the current losses in the passive coils connected to the STEVAL-IFS007V1 board. They act as oscillators and integrate the sensing part constituted of the coil (typically 330 µH, 0.54 A standard coil) and an external conditioning circuitry useful to adjust the detection distance
- Each proximity detector is powered by a common 24 V supply

The layout of the STEVAL-IFS007V1 board is shown below.

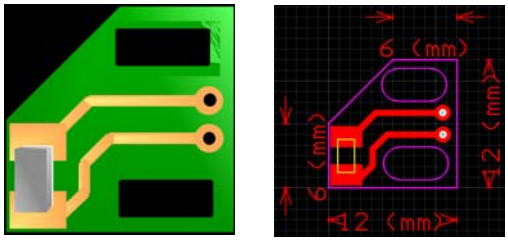
Figure 2. STEVAL-IFS007V1 layout



1.1 The coil support

Figure 3 shows an example of a physical support able to host the coil. This could be done for the remote positioning of the sensing elements (the 2 square holes are useful to fix the plaque to external supports, walls, etc.).

Figure 3. Design of the plaque with the physical dimensions



1.2 The CLT3-4BT6 board

The current limited termination demonstration board is a quad input/output digital termination interface designed for 24 Vdc automation applications. It achieves the front-end circuitry of a digital input module (IO) in industrial automation environments.

This board is made of a parallel input voltage protection, a serial input-output current limiting circuit, and an opto-coupler driver. Each channel circuit terminates the connection between the logic input and the associated high side sensor (2-3 wire sensors) or switch.

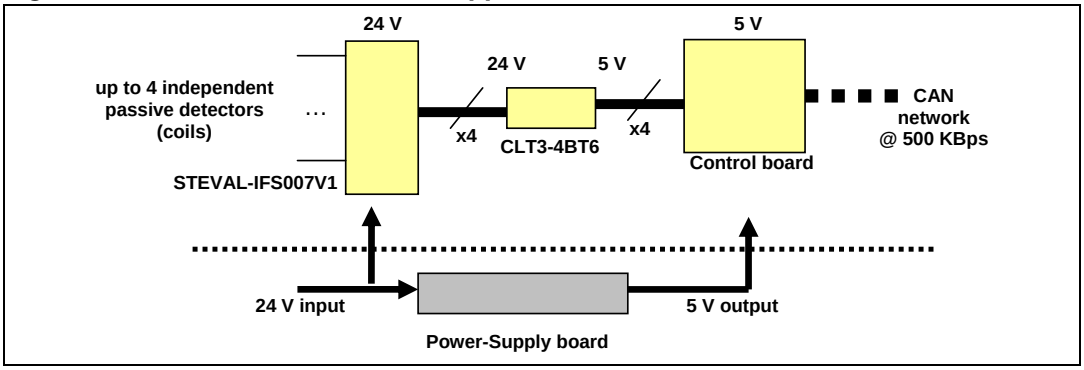
Figure 4. The CLT3-4BT6 board



2 Proxy board application example

This chapter describes a system integrating the proxy board, the CLT34BT6 board previously described, and a control board that allows communication through a CAN (Controller Area Network) network, for example in industrial environments. The system can be intended for local and remote alert applications in distributed control environments needing a robust communication protocol like CAN. The mentioned control board (on the right side of *Figure 5*) must function as a collector of signals coming from the interface board CLT3-4BT6, able to perform local alert through LED on/off, and remote alert when connected to other control boards communicating with the CAN protocol with same parameters. The board depicted in grey and called power supply board can be optionally part of the system, especially if only the 24 V power source is present. *Figure 5* below identifies the four main blocks of the system.

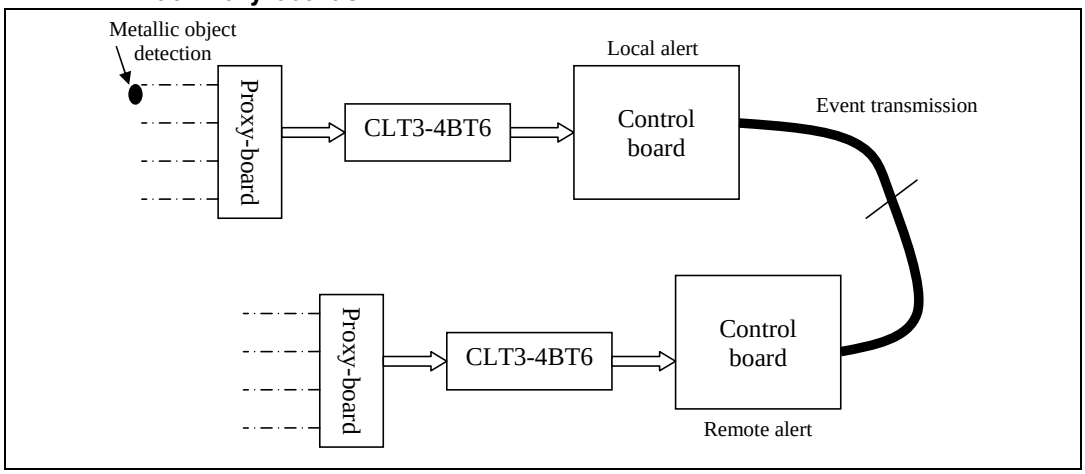
Figure 5. The boards used in the application



2.1 Application description

In this section, a typical application is explained.

Figure 6. Application example using two STEVAL-IFS007V1 boards and the related auxiliary boards



Referring to *Figure 6* above and describing the case of a network with only two nodes, in order to use this demonstration kit as effectively as possible, it is recommended to follow the instructions below.

- First of all, supply the system boards. To supply the proxy board use a DC power supply laboratory equipment providing a stabilized voltage at 24 Vdc. In this case, no standard connectors are needed as it is possible to see on the board itself. The CLT3-4BT6 board is supplied by connecting it to the proxy board for the input stage and to the control board for the output stage. To do this, please pay special attention to the arrangement of the pins on the boards, by referring to the silkscreen of the boards themselves: do not exchange Vcc and GND pins, in order to make the connections safe.

Note: Important: if the above first steps were followed, the power supply board is not needed. Do not connect this as it has no impact on system functionality. A power supply board could be helpful only if a power supply is available in your laboratory equipment, in order to help you in obtaining a 5 V supply from the 24 V supply you are able to provide.

- Running the system. Even if it is possible to attach up to 4 passive detectors, in order to simplify the procedure, start by attaching just one coil to one of the four channels of the proxy board. It is possible to plug in the coil directly to the connector or use a couple of wires in order to have a distance between the point of measurement and the proxy board where the TDA0161 are hosted (distance of up to 2 m). Concerning the coil, please refer to the TDA0161 datasheet to choose the most appropriate coil, the application uses a 330 uH/0.54 A standard coil.
- Once the steps above are completed, a chain of blinking LEDs is visible, one on each board: the corresponding one on the proxy board, if you use only one detector, the one on the corresponding channel on the CLT3-4BT6 interface protection board and the

one(s) on the control board displayed by the firmware in order to signal the object approaching the node.

- The functionality of the systems can be completed by connecting a second node to the CAN connector. To do this, attach a second control board with the same firmware running on the first one or program a new board, even if mounting a different microcontroller. Follow the specifications written in the next section in order to arrange the right settings in its CAN peripheral.

3 Board schematic

Figure 7. The STEVAL-IFS007V1 schematic

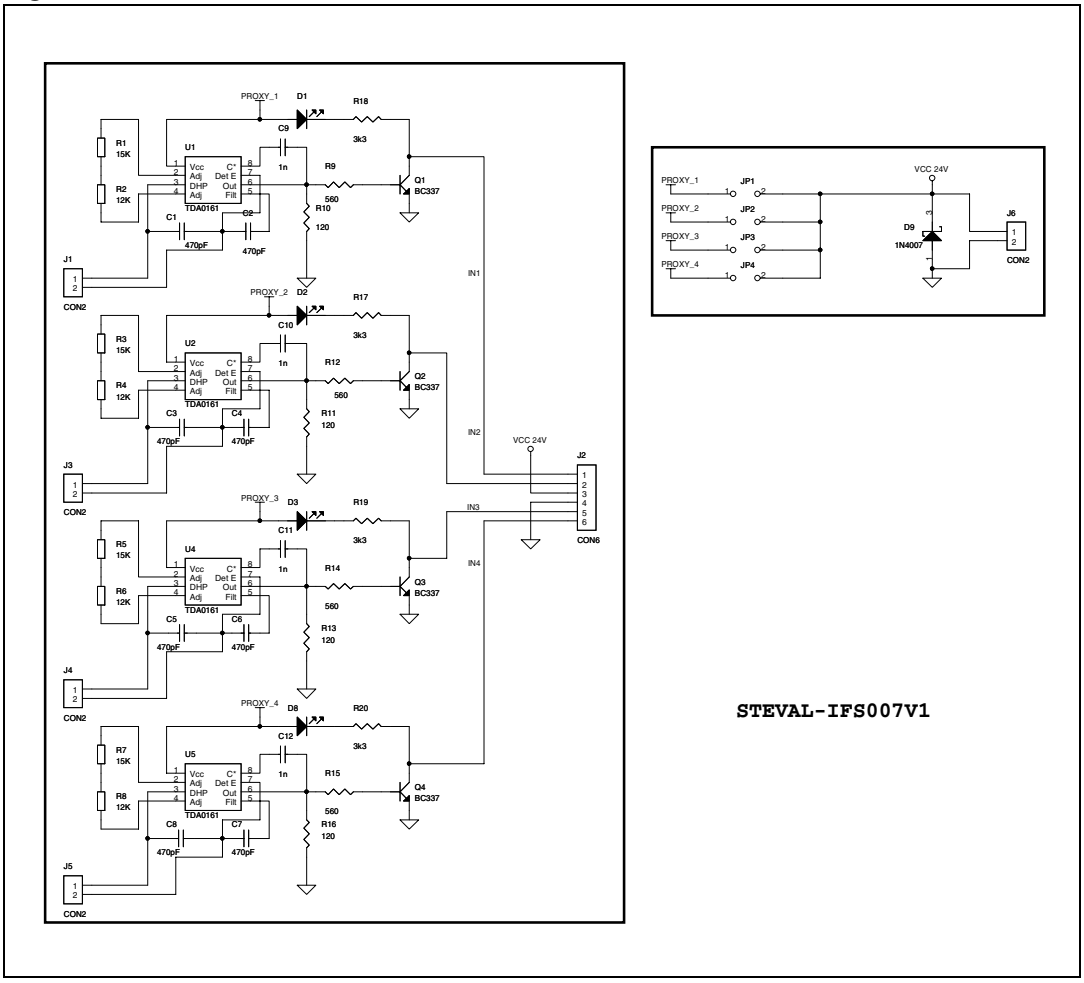


Table 1. Bill of materials

ID	Qty	Part reference	Value	Device type	Manufacturer	Order code
1	8	C1,C2,C3,C4,C5, C6,C7,C8	470 F	50 V	Any	-
2	4	C9,C10,C11,C12	1 nF	50 V	Any	-
3	4	D1,D2,D3,D8	LED-yellow color ø3 mm	ø3 mm	Any	-
4	1	D9	1N4007		Any	-
5	4	JP1,JP2,JP3,JP4	2-pin standard male strip-line		Any	-
6	5	J1,J3,J4,J5,J6	CON2		Any	-
7	1	J2	6-pin standard male strip-line		Any	-
8	4	Q1,Q2,Q3,Q4	BC337-25	NPN standard BJT	Any	-
9	4	R1,R3,R5,R7	15 kΩ	¼ W	Any	-
10	4	R2,R4,R6,R8	12 kΩ	¼ W	Any	-
11	4	R9,R12,R14,R15	560 Ω	¼ W	Any	-
12	4	R10,R11,R13,R16	120 Ω	¼ W	Any	-
13	4	R17,R18,R19,R20	3.3 kΩ	¼ W	Any	-
14	4	U1,U2,U4,U5	TDA0161DP		STMicroelectronics	TDA0161DP

4 Revision history

Table 2. Document revision history

Date	Revision	Changes
20-Mar-2008	1	Initial release.

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