ThinkIO™ - Duo

Intel® Core™ Duo DIN Rail PC

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Hardware Guide

kontron

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Disclaimer

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Caution, Electric Shock!

This symbol and title warn of hazards due to electrical shocks (> 60V) when touching products or parts of them. Failure to observe the precautions indicated and/or prescribed by the law may endanger your life/health and/or result in damage to your material.

Please refer also to the section “High Voltage Safety Instructions” on the following page.

Warning, ESD Sensitive Device!

This symbol and title inform that electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

Please read also the section “Special Handling and Unpacking Instructions” on the following page.

Warning!

This symbol and title emphasize points which, if not fully understood and taken into consideration by the reader, may endanger your health and/or result in damage to your material.

Note ...

This symbol and title emphasize aspects the reader should read through carefully for his or her own advantage.

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Caution, Electric Shock!

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Serious electrical shock hazards can exist during all installation, repair and maintenance operations with this product. Therefore, always unplug the power cable and any other cables which provide external voltages before performing work.

Special Handling and Unpacking Instructions

ESD Sensitive Device!

Electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

- Do not handle this product out of its protective enclosure while it is not used for operational purposes unless it is otherwise protected.
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- This device should only be installed in or connected to systems that fulfill all necessary technical and specific environmental requirements. This applies also to the operational temperature range of the specific board version, which must not be exceeded. If batteries are present, their temperature restrictions must be taken into account.
- In performing all necessary installation and application operations, please follow only the instructions supplied by the present manual.
- Keep all the original packaging material for future storage or warranty shipments. If it is necessary to store or ship the board, please re-pack it as nearly as possible in the manner in which it was delivered.
- Special care is necessary when handling or unpacking the product. Please consult the special handling and unpacking instruction on the previous page of this manual.

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Kontron grants the original purchaser of Kontron's products a ***TWO YEAR LIMITED HARDWARE WARRANTY*** as described in the following. However, no other warranties that may be granted or implied by anyone on behalf of Kontron are valid unless the consumer has the express written consent of Kontron.

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Chapter 1

Introduction

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1. Introduction

1.1 About This Guide

This Hardware Reference Guide is intended to familiarize the user with the ThinkIO-Duo hardware specifications and functions.

1.2 The ThinkIO-Duo

The ThinkIO-Duo DIN Rail PC is a part of an innovative concept to integrate high performance PC functionality and DIN Rail input / output modules to provide system integrators with a complete range of off-the-shelf solutions for industrial automation applications.

Packaged in a DIN rail mountable housing, 224 x 70 x 100 mm, the ThinkIO-Duo provides standard interfacing for Fast and Gigabit Ethernet, USB, serial communications, TFT/CRT display, and user definable digital I/Os.

In addition, the ThinkIO-Duo can be fitted with an optionally available WAGO interface module (K-Bus) which provides direct access to the complete family of the WAGO-I/O-SYSTEM 750/753 input / output modules.

The following figures illustrate the physical layout of the ThinkIO-Duo and its interfacing capabilities.

Figure 1-1: ThinkIO-Duo with WAGO Interface Module (K-Bus) Assembled

Figure 1-2: Rear View of ThinkIO-Duo without the WAGO Interface Module (K-Bus)

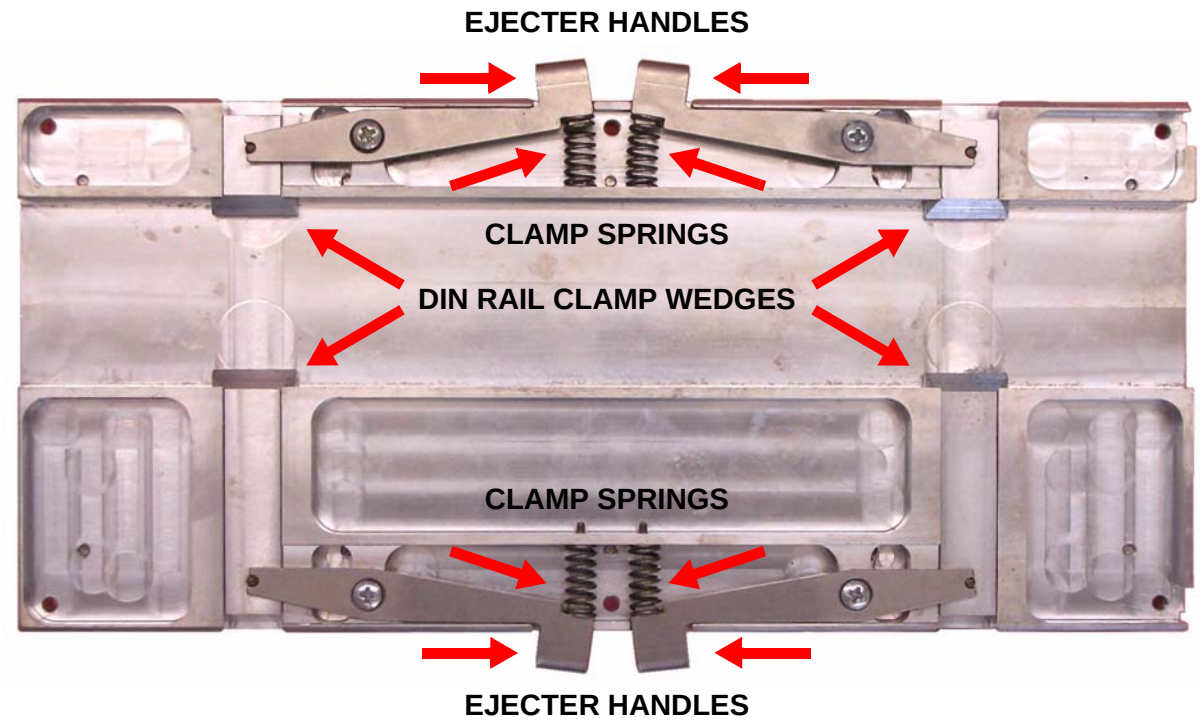

Figure 1-3: View of WAGO Interface Module (K-Bus) - I/O Module Side

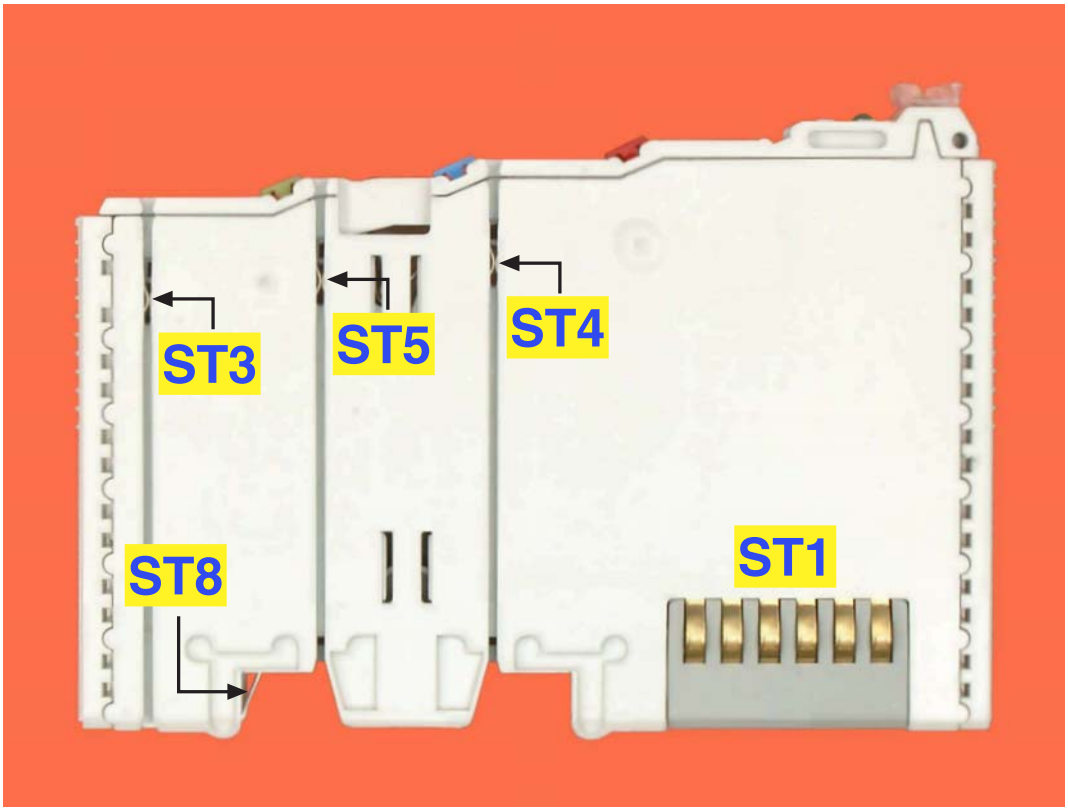

Figure 1-4: ThinkIO-Duo Application System Interfacing Diagram

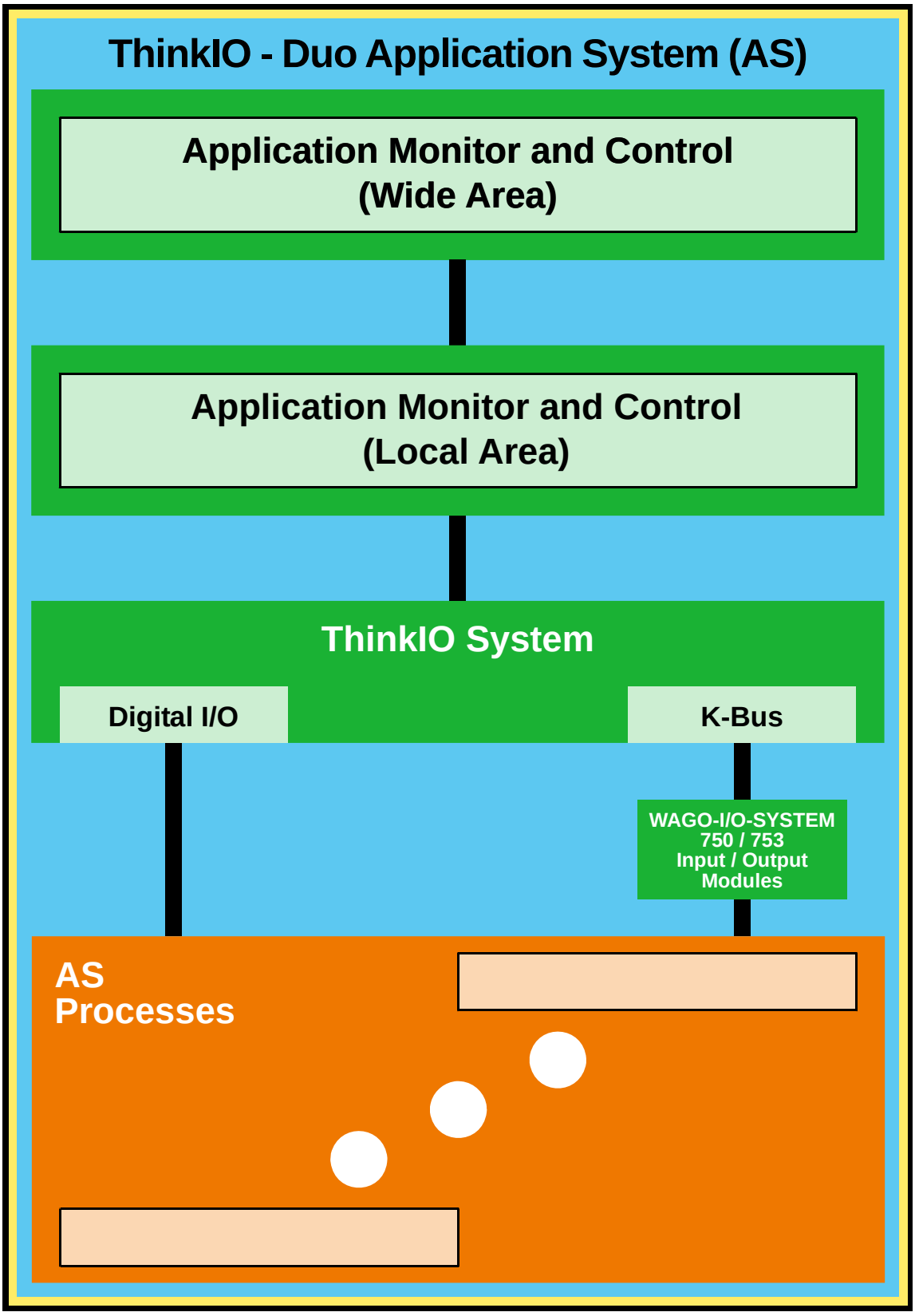

Figure 1-5: ThinkIO-Duo with WAGO Interface Module (K-Bus) External Interfacing

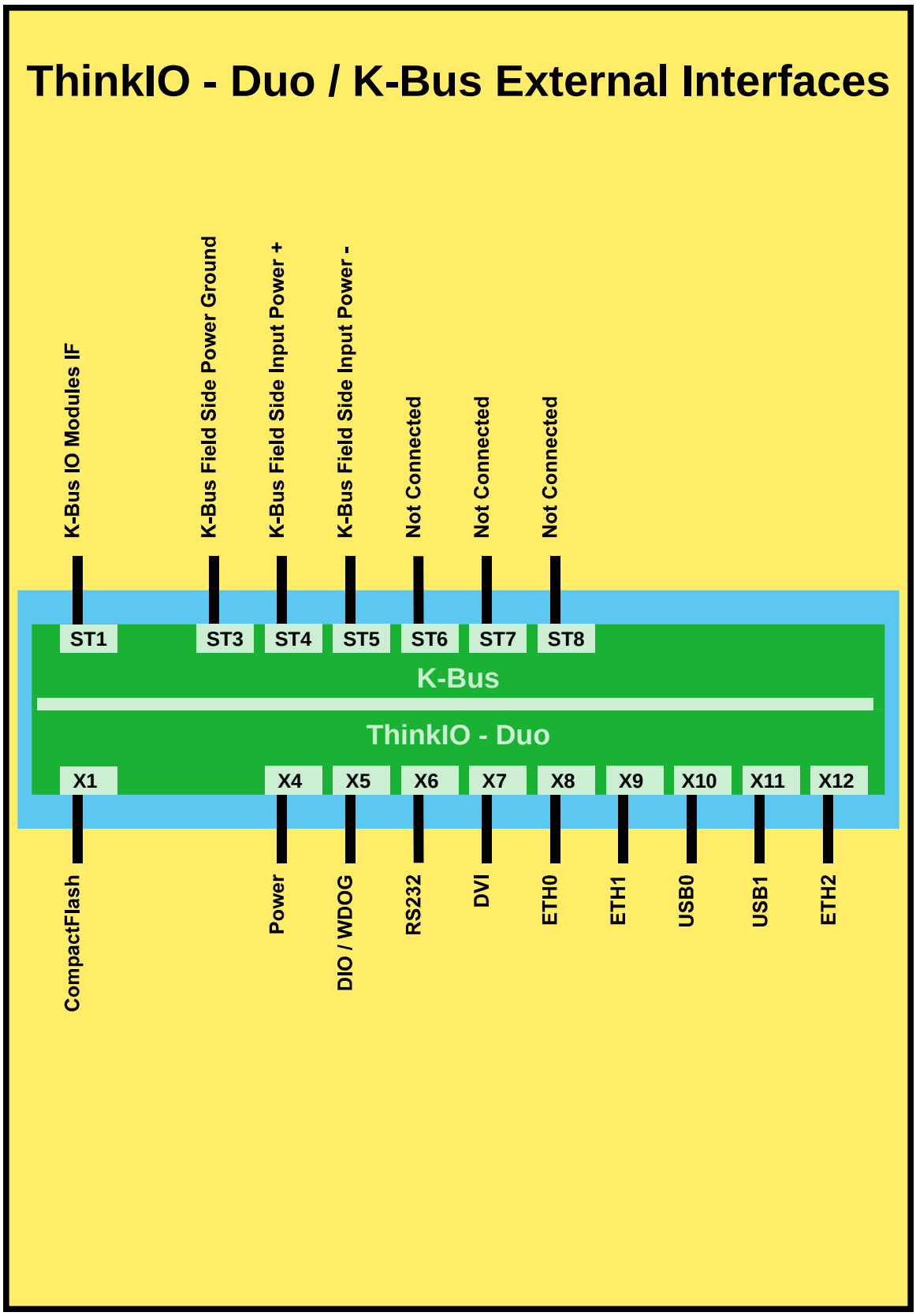

Figure 1-6: Top and Bottom Views of WAGO Interface Module (K-Bus)

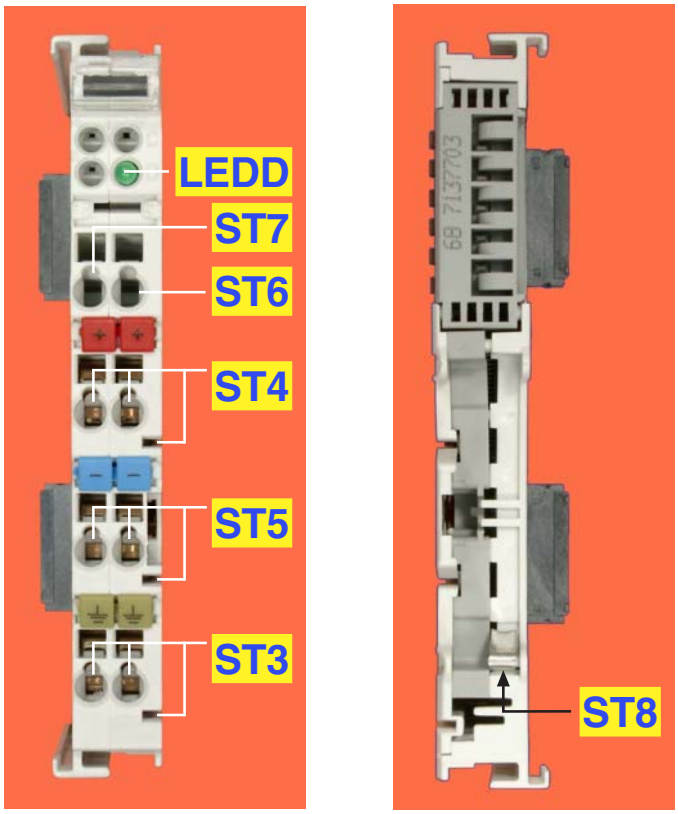

Figure 1-7: ThinkIO-Duo with K-Bus Module and WAGO IO Modules

1.3 Technical Specifications

Table 1-1: ThinkIO-Duo Main Specifications

	DESIGNATOR	SPECIFICATIONS
CPU	CPUs	The following CPU configuration is available: • Intel® Core™ Duo processor U2500 (ULV), 1.2 GHz, 533 MHz FSB, 2 MB L2 cache
Memory	Main Memory	Up to 2 GB of soldered single/dual die DDR2 SDRAM, 533 MHz, no ECC
	Flash (BIOS)	8 Mbit Firmware Hub (FWH)
	Non-volatile RAM	256k x 16-bit MRAM
	Mass Storage	Up to 2048 MB soldered IDE Flash
ThinkIO-Duo Interfaces	Application Process and Monitor and Control	Types: - Gigabit Ethernet (two, 10/100/1000BASE-T, ETH0, ETH1) - Fast Ethernet (one, 10/100BASE-TX, ETH2) - PanelLink (one, DVI (TFT/CRT)) - Serial (one, RS232) - USB (two, USB 2.0, USB0, USB1) - Digital input (seven channels) - Digital output (two channels) - Watchdog (one PLC output channel with relay contacts - CompactFlash, type I/II - Run / Stop switch - Reset switch - Operational status indicators (four LEDs)
K-Bus (Optional)	WAGO Interface Module (K-Bus)	WAGO-I/O-SYSTEM 750/753 WAGO interface module (K-Bus) - compatible to all of WAGO's "750/753"-Series input / output modules - Form factor: W x H x L: 12 mm x 70 mm x 100 mm
	IO Modules and Field Side Power	Types: - I / O bus for WAGO-I/O-SYSTEM 750/753 input / output modules - + 5 V power bus for input / output modules - Field side power supply via power jumper contacts - Operational status indicator (one LED)

Table 1-1: ThinkIO-Duo Main Specifications (Continued)

	DESIGNATOR		SPECIFICATIONS
Power Interfaces	X4	+ 24 V	Main input power interface to the ThinkIO-Duo: - Tolerance: - 25% to +30% - 3-pin male receptacle
	ST1 (K-Bus)	+ 5 V	Input power interface to input / output module electronics - Maximum current load: 1.0 A - Power jumper contacts
	ST4 (K-Bus)	EXT +	Field side input power interface to input / output modules - Is function of application requirements (module types installed and their power requirements) - Electrically isolated from module electronics - Maximum electrical loading: 10 A - Contacts: - Double CageClamp™, internally bridged - Power jumper contact, female, internally bridged to CageClamp™
	ST5 (K-Bus)	EXT -	Field side input power interface to input / output modules - Is function of application requirements (module types installed and their power requirements) - Electrically isolated from module electronics - Maximum electrical loading: 10 A - Contacts: - Double CageClamp™, internally bridged - Power jumper contact, female, internally bridged to CageClamp™
	ST3 (K-Bus)	Shield (Ground)	Field side power shielding (ground) interface to input / output modules - Is function of application requirements (module types installed and their power requirements) - Electrically isolated from module electronics - Contacts: - Double CageClamp™, internally bridged - Power jumper contact, female, internally bridged to CageClamp™
	ST8 (K-Bus)	Shield (Ground)	WAGO interface module (K-Bus) to DIN rail ground contact - Contact: - Sliding spring - Internally not connected

Table 1-1: ThinkIO-Duo Main Specifications (Continued)

	DESIGNATOR	SPECIFICATIONS
General	Electrical	Main input power voltage: + 24 V DC (nominal) Main input power range: - 25% to + 30%
	Power Consumption	ThinkIO-Duo operational configuration with devices connected to both USB ports, all three Ethernet ports, and the K-bus with five WAGO I/O modules installed: - 30 watts maximum @ 24 volts A maximum of 5 watts @ 5 volts is available for I/O modules via the ThinkIO-Duo. If more power is needed, (an) additional WAGO-IO-SYSTEM 750 internal power supply module(s) (750-613) must be added to satisfy power requirements. It may even be necessary to provide additional 24 VDC input power to the internal power supply module(s).
	Temperature Range	Operational: 0ºC to +55ºC Standard Storage: -25ºC to +85ºC
	Climatic Humidity	93% r.h. at 40° C, non-condensing (acc. to IEC 60068-2-78)
	Dimensions	Form factor: ThinkIO-Duo assembled with WAGO interface module (K-Bus) - W x H x L: 236 mm x 70 (65*) mm x 100 mm * from upper edge of 35 DIN rail Form factor: ThinkIO-Duo stand-alone - W x H x L: 224 mm x 70 (65*) mm x 100 mm * from upper edge of 35 DIN rail
	Weight(s)	ThinkIO-Duo plus WAGO interface module (K-Bus): 1055 g ThinkIO-Duo in stand-alone configuration: 1016 g

1.4 Applied Standards

The Kontron's ThinkIO-Duo DIN Rail PC complies with the requirements of the following standards:

Table 1-2: Applied Standards

COMPLIANCE	TYPE	STANDARD	REMARKS
CE	Emission	EN55022 EN61000-6-3	
	Immission	EN55024 EN61000-6-2	
	Electrical Safety	EN60950-1	The ThinkIO-Duo is specified I/O only for: SELV and EVL. It is NOT SPECIFIED for "Hazardous"
	PLC Product Standard	EN61131-2	EMC-Zone "A" and "B"
Mechanical	Mechanical Dimensions	EN 50022	
Environmental and Health Aspects	Vibration (Sinusoidal)	IEC60068-2-6	
	Shock	IEC60068-2-27	
	Temperature Tests A: Cold	IEC 60068-2-1	
	Temperature Tests B: Dry Heat	IEC 60068-2-2	
	Climatic Humidity	IEC60068-2-78	93% RH at 40 °C, non-condensing
	WEEE	Directive 2002/96/EC	Waste electrical and electronic equipment
	RoHS	Directive 2002/95/EC	Restriction of the use of certain hazardous substances in electrical and electronic equipment

Warning!

To satisfy CE requirements regarding ESD protection, special dust caps must be installed on connectors X6, and X7 (RS232, and DVI) when these connectors are not in use, i.e. no cable is connected. This is intended to prevent electrostatic discharging to the pins of these connectors.

Appropriate dust caps are supplied with the ThinkIO-Duo. In the event they are damaged or lost, replacement caps may be obtained by contacting Kontron.

1.5 Related Publications

Table 1-3: Related Publications

	ISSUED BY	DOCUMENT
WAGO-I/O-SYSTEM	WAGO Kontakttechnik GmbH	WAGO-I/O-SYSTEM 750 Input / Output Modules WAGO-I/O-SYSTEM 753 Input / Output Modules with Pluggable Field Wiring Internet Address: www.wago.com

Chapter 2

Interfaces

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2. Interfaces

The following chapters present interface information about the ThinkIO-Duo DIN Rail PC.

2.1 General Information

The ThinkIO-Duo provides the following interfaces:

- X1: a CompactFlash card, type I/II, socket
- X4: a power connector for 24 V DC main power input
- X5: a connector for digital inputs and outputs
- X6: a serial communications connector
- X7: a DVI-type, PanelLink, display connector for a TFT or CRT
- X8: a Gigabit Ethernet connector (ETH0) for a network
- X9: a Gigabit Ethernet connector (ETH1) for a network
- X10: a USB device connector (USB0)
- X11: a USB device connector (USB1)
- X12: a Fast Ethernet connector (ETH2) for a network

In addition, the optional WAGO interface module (K-Bus) provides the following interfaces:

- ST1: a bus type interface for data exchange with WAGO-I/O-SYSTEM 750/753 I/O modules
- ST3: a field side power ground interface
- ST4: a field side power input interface
- ST5: a field side power input interface

2.2 X1 CompactFlash

This interface is a standard IDE type interface which supports CompactFlash cards (type I and II) including IBM Microdrives or similar devices.

2.3 X4 Power

The ThinkIO-Duo input power should nominally be 24 V DC, whereby a tolerance range of -25% to +30% (18.0 V DC … 31.2 V DC range) is permitted. The connector for this interface is a 3-pin, male, WAGO connector.

The following figure and table provide pinout information for this interface.

Figure 2-1: X4 Power

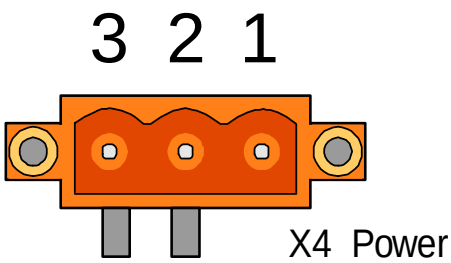


Table 2-1: X4 Power

SIGNAL	PIN
V_IN (+)	1
GND (-)	2
Shield (⏚)	3

2.4 X5 Digital Input / Output

The connector for this interface is a 15-pin, female, D-Sub connector. It provides seven digital input channels, two digital output channels, and one Watchdog relay output channel.

The following figures and tables provide detailed information for this interface.

For further information concerning the PLC Watchdog Timer, refer to chapter 3.5 of this guide.

Figure 2-2: X5 Digital I/O

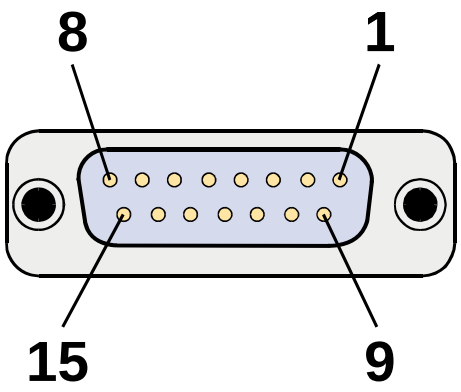


Table 2-2: X5 Digital I/O

SIGNAL	PIN
DIN[0]	1
DIN[2]	2
DOUT+[0]	3
DOUT+[1]	4
DIN[4]	5
DIN[6]	6
REL_NO	7
REL_NC	8
DIN[1]	9
DIN[3]	10
DOUT-[0]	11
DOUT-[1]	12
DIN[5]	13
DIN-ref	14
WDG_OUT	15

WARNING!

This interface is **not compatible** with its ThinkIO-P counterpart.

Existing applications which are upgraded from ThinkIO-P to ThinkIO-Duo must be modified to take into consideration that the signals and pinouts of this interface are not compatible.

Failure to comply with the above may result in damage to the ThinkIO-Duo or injury to personnel. Kontron will not assume any liability resulting from failure to comply with the above.

Table 2-3: Digital Input Characteristics

CHARACTERISTIC	DESCRIPTION
Voltage range	Low: - 3 V to + 5 V High: + 11 V to + 30 V (+ 24 V standard)
Current	8 mA maximum per channel
Channels	7
Channel Connection	1 pin per channel, single ended, plus reference pin for all DIN channels Each channel can be configured separately as required.
Input Impedance	Minimum: 1.5 kOhm Maximum: 3 kOhm @ 30 V
Other Features	Optoisolation: 2 kV to system Current Limitation Overvoltage protection: 8 kV ESD Peak Pulse Power (tp = 8/20µs): Ppk = 300 W Inverse polarity protection Propagation delay of input signal from IO connector to capture in PLD: Tpd = 1µs

Figure 2-3: Functional Drawing of Single Digital Input

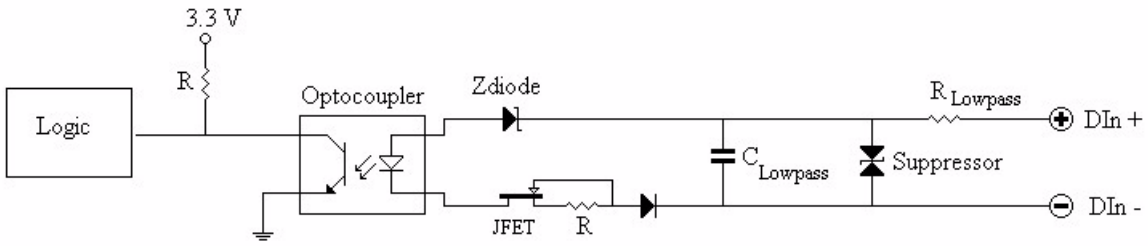


Figure 2-4: Connection to the Digital Inputs

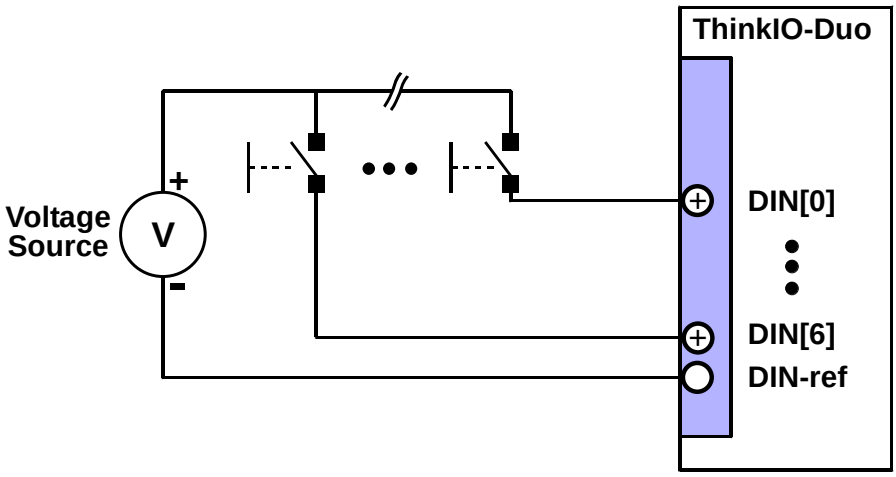
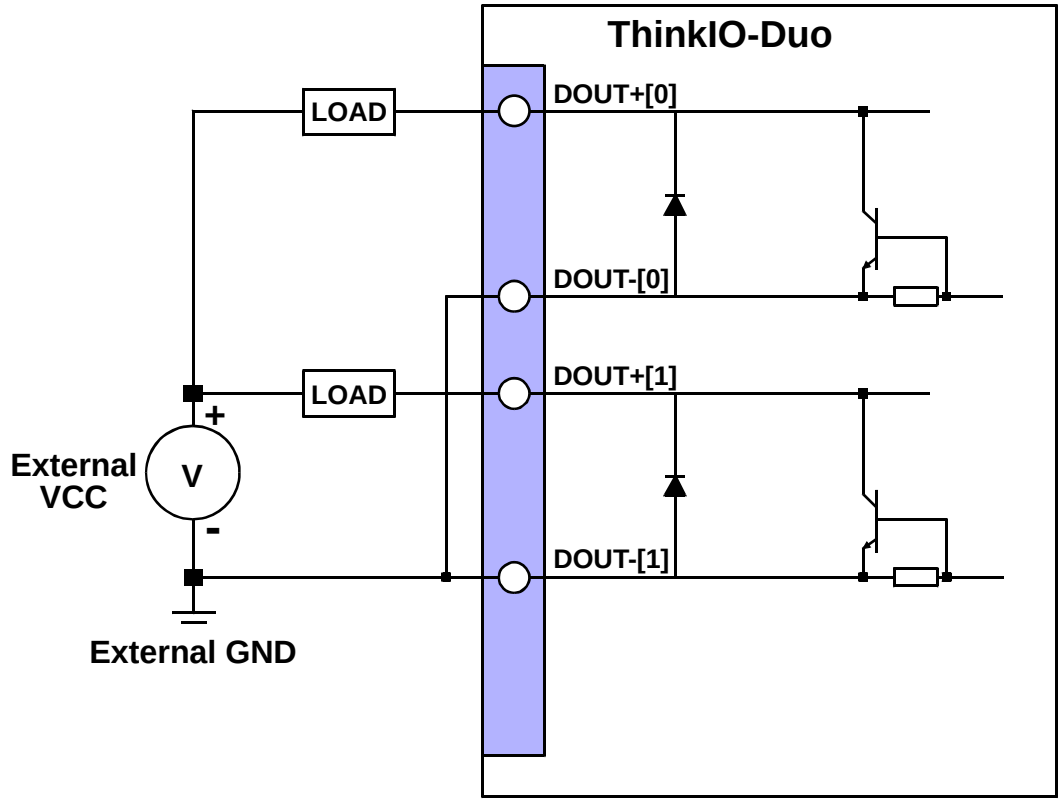


Table 2-4: Digital Output Characteristics

CHARACTERISTIC	DESCRIPTION
External VCC	Maximum VCC: 24 VDC
Current	100 mA typical 200 mA absolute maximum
Channels	2
Channel Connection	2 pins per channel, single ended Each channel can be configured separately as required.
Other Features	Optoisolation 2 kV to system Current Limitation Inverse polarity protection

Figure 2-5: Connection to the Digital Outputs



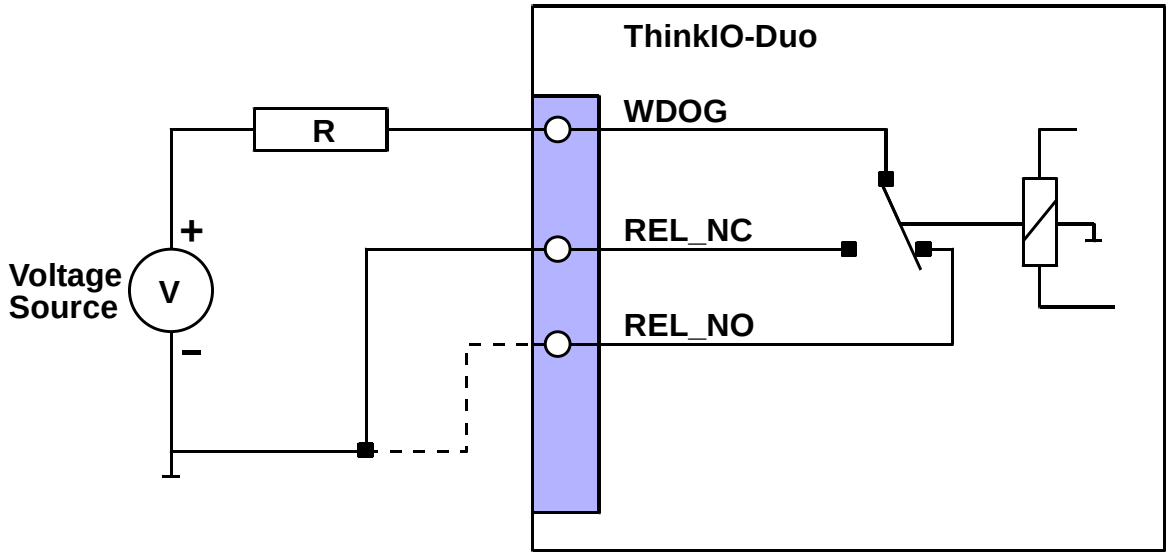
Note ...

In the case of the digital outputs, the load may be either high side switched or low side switched.

Table 2-5: PLC Watchdog Output Characteristics

CHARACTERISTIC	VALUE
Relay Output	DIO/WDG connector, X5 Pin 7: REL_NO Pin 8: REL_NC Pin 15: WDG_OUT
Switching Voltage	32 VDC maximum
Switching Current	1A maximum

Figure 2-6: Connection of PLC Watchdog Outputs



Note ...

The relay shown above has no power applied. This relay is controlled by the Watchdog function.

2.5 X6 Serial Communications

The connector for this interface is a 9-pin, male, D-Sub connector. This is a standard RS2323 interface with full handshaking capability.

The following figure and table provide pinout information for this interface.

Figure 2-7: X6 Serial Communications

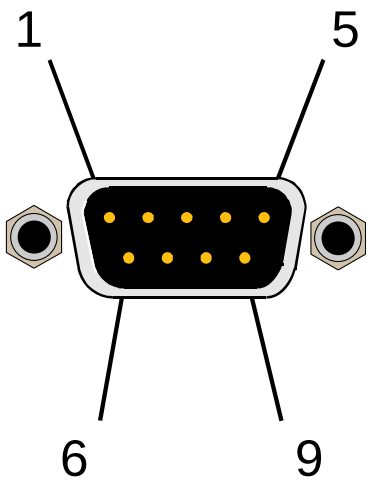


Table 2-6: X6 Serial Communications

SIGNAL	PIN
DCD1	1
RXD1	2
TXD1	3
DTR1	4
GND	5
DSR1	6
RTS1	7
CTS1	8
RI1	9

2.6 X7 DVI

The connector for this interface is a 30-contact, female DVI compliant combined analog and digital receptacle connector.

The following figure and table provide pinout information for this interface.

Figure 2-8: X7 DVI

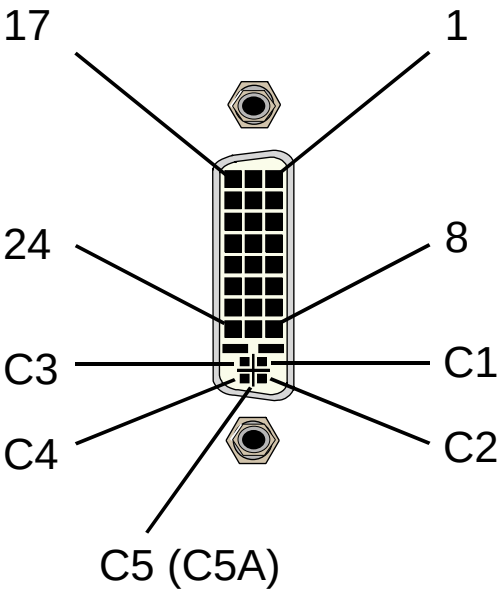


Table 2-7: X7 DVI

SIGNAL	PIN	SIGNAL	PIN	SIGNAL	PIN
TXD2-	1	TXD1-	9	TXD0-	17
TXD2+	2	TXD1+	10	TXD0+	18
GND	3	GND	11	GND	19
NC	4	NC	12	NC	20
NC	5	NC	13	NC	21
DDCCLK	6	VCC_DVI	14	GND	22
DDCDATA	7	GND	15	TXCP	23
CRT_VSY	8	NC	16	TXCN	24
CRT_R	C1	CRT_G	C2	CRT_B	C3
CRT_HSY	C4	GND	C5	GND	C5A

WARNING!

To satisfy CE requirements regarding ESD protection, a special dust cap must be installed on this connector when it is not in use, i.e. no cable is connected. This is intended to prevent electrostatic discharging to the pins of these connectors.

An appropriate dust cap is supplied with the ThinkIO-Duo. In the event it is damaged or lost, a replacement cap may be obtained by contacting Kontron Modular Computers.

2.7 X8 and X9 Gigabit Ethernet

These are 10BASE-T/100BASE-TX/1000BASE-T Gigabit Ethernet compliant interfaces. The connectors for these interfaces are an 8-contact, RJ45 type connector. In addition, there are two operational status LEDs built into each connector: ACT/LNK (yellow) and Speed (green/orange). Both of these interfaces support network booting.

ACT/LNK (yellow): This LED monitors network connection and activity. The LED lights up when a valid link (cable connection) has been established. The LED goes temporarily off if network packets are being sent or received through the RJ45 port. When this LED remains off, a valid link has not been established due to a missing or a faulty cable connection.

SPEED (green/orange): This LED lights up to indicate a successful 100Base-TX or 1000BASE-T connection. When green it indicates a 100Base-TX connection and when orange it indicates a 1000Base-T connection. When not lit and the ACT/LNK LED is active, the connection is operating at 10Base-T.

The following figure and table provide pinout information for these interfaces.

Figure 2-9: X8 and X9 Gigabit Ethernet

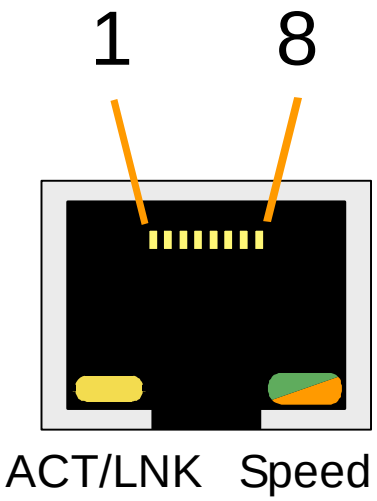


Table 2-8: X8 and X9 Gigabit Ethernet

10BASE-T		100BASE-TX		1000BASE-T		PIN
I/O	SIGNAL	I/O	SIGNAL	I/O	SIGNAL	
O	TX+	O	TX+	I/O	BI_DA+	1
O	TX-	O	TX-	I/O	BI_DA-	2
I	RX+	I	RX+	I/O	BI_DB+	3
-	-	-	-	I/O	BI_DC+	4
-	-	-	-	I/O	BI_DC-	5
I	RX-	I	RX-	I/O	BI_DB-	6
-	-	-	-	I/O	BI_DD+	7
-	-	-	-	I/O	BI_DD-	8

2.8 X10 and X11 USB

The connector for this interface is a USB standard compliant connector.

The following figure and table provide pinout information for this interface.

Figure 2-10: X10 and X11 USB

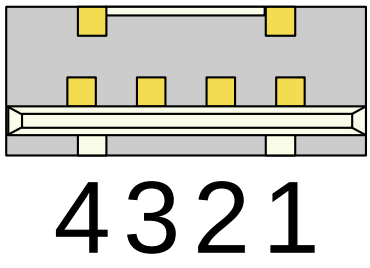


Table 2-9: X10 and X11 USB

SIGNAL	PIN
USB_GND	4
USB_P1	3
USB_N1	2
USB_VCC1	1

2.9 X12 Fast Ethernet

This is a 10BASE-T/100BASE-TX Fast Ethernet compliant interface. The connector for this interfaces is an 8-contact, RJ45 type connector. In addition, there are two operational status LEDs positioned above the connector to indicate the link status and speed. This is the third Ethernet interface and is designated as ETH2. This interface does not support network booting.

ACT/LNK (yellow): This LED monitors network connection and activity. The LED lights up when a valid link (cable connection) has been established. The LED goes temporarily off if network packets are being sent or received through the RJ45 port. When this LED remains off, a valid link has not been established due to a missing or a faulty cable connection.

SPEED (green): This LED lights up to indicate a successful 100Base-TX connection. When not lit and the ACT/LNK LED is active, the connection is operating at 10Base-T.

The following figure and table provide pinout information for these interfaces.

Figure 2-11: X12 Fast Ethernet

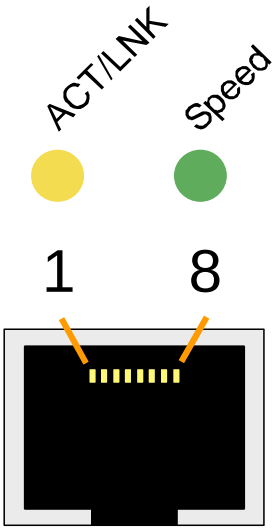


Table 2-10: X12 Fast Ethernet

10BASE-T		100BASE-TX		PIN
I/O	SIGNAL	I/O	SIGNAL	
O	TX+	O	TX+	1
O	TX-	O	TX-	2
I	RX+	I	RX+	3
-	-	-	-	4
-	-	-	-	5
I	RX-	I	RX-	6
-	-	-	-	7
-	-	-	-	8

2.10 WAGO Interface Module (K-Bus) (Optional)

The WAGO interface module (K-Bus) provides system interfacing between the ThinkIO-Duo and the WAGO-I/O-SYSTEM 750/753 I/O modules. For a description of the WAGO I/O modules and their operation refer to the WAGO documentation.

The following interfaces are available on the WAGO interface module (K-Bus):

- I/O modules (ST1)
- Field side power (ST3, 4, 5, 6, 7, 8)
- Operational status LED D

2.10.1 System (ST1)

This interface provides interfacing between the WAGO interface module (K-Bus) and the WAGO-IO-SYSTEM 750/753 input/output modules. It supplies 5 volt power to the K-Bus as well as providing for control and data exchange between the K-Bus module and the input/output modules.

2.10.2 Power (ST3, 4, 5, 6, 7, 8)

The ST3/4/5 interfaces provide power interfacing capability via the WAGO interface module (K-Bus) to the WAGO-IO-SYSTEM 750/753 input/output modules. They are physically isolated from the K-Bus module electronics and the ThinkIO-Duo and serve only as distribution points for field side supply power to other WAGO IO modules.

The following table provides pinout information for these interfaces.

Table 2-11: Power (ST3, 4, 5, 6, 7, 8)

CONNECTOR	MARKING	DESCRIPTION
ST3	GND GND	Input power ground or shield - dual CageClamp™ plus power jumper contact to next IO module
ST4	+ +	Input power plus voltage - dual CageClamp™ plus power jumper contact to next IO module
ST5	- -	Input power minus voltage - dual CageClamp™ plus power jumper contact to next IO module
ST6, ST7, ST8	none	Dummy connectors - not connected internally

WARNING!

If the K-Bus field side terminals ST4 and ST5 are to be used, **apply only +24V DC** to these interfaces.

Failure to comply with the above will result in damage to the K-Bus module and voiding of the Kontron product warranty.

Refer to WAGO documentation for further information regarding power and configuration requirements for IO modules.

2.10.3 Operational Status LED D

This interface indicates whether or not if field side power is applied to the WAGO interface module (K-Bus). When on, it indicates the presence of field side power (24 V DC). When off, there is no field side power applied to the WAGO IO system.

Chapter 3

Monitor and Control (M/C)

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3. Monitor and Control (M/C)

3.1 ThinkIO-Duo LEDs

The ThinkIO-Duo has four LEDs visible from the front of the ThinkIO-Duo for indicating various operational status information. Typical indicators are implemented along with POST code indications using the same LEDs during power-up and operation.

Only one type of LED is used for all LED ports. For maximum flexibility, a multi-color, red and green, LED is used. The architecture of this LED type permits the red and green color LEDs to be driven in parallel thus providing a kind of amber (or yellow) color.

3.1.1 Modes of Operation

The different modes of operation for the LED port can be grouped into:

- POST, and
- Operational

In the operation mode, the LEDs are mapped from right to left: IDE/PWR, TEMP, KBUS, APPL.

In the POST mode, these LEDs form an 4-bit wide port to display POST codes in binary format (nibble multiplexed). The right most LED is the least significant bit for POST code representation. POST mode is entered by default on power-up.

The POST code itself is divided into two nibbles: low = D[3...0], high = D[7...4]. Output of the low nibble is in red, the high nibble is green. Together they make up one byte of information.

For detailed information concerning the POST codes, refer to the ThinkIO-Duo BIOS Guide.

3.1.2 Status Indications

The following table provides an overview of the functions indicated by the various LEDs. For detailed information concerning LED operation for the K-Bus refer to section 3.6.

Table 3-1: ThinkIO-Duo LED Functions

INDICATOR	FUNCTION
APPL	Free programmable User LED Color: green, red, amber; state: off, on steady, flashing
KBUS	Operational status indication of the WAGO interface module (K-Bus) for WAGO-I/O-SYSTEM 750/753 modules. Refer to section 3.6 for further information concerning the usage of this LED.
TEMP	Status indication of a Thermal Alarm for the CPU. Color: green; state: on steady; driven when CPU is within its normal operating temperature. Color: red; state: on steady; driven when CPU is in an over temperature operating state.
IDE/Power	Status indication for IDE (CompactFlash) activity and main input power to the ThinkIO-Duo. Color: green; state: on steady; driven when main input power is applied and IDE is inactive. Color: red; state: on steady; driven when main input power is applied and IDE is active. The LED indication toggles between green and red when IDE activity occurs.

The APPL and KBUS LEDs are also used during the pre-POST phase for displaying active RESET (APPL, red when reset active) and POWER GOOD (KBUS, red when power not good).

3.2 Run/Stop Switch

This switch provides an operational control function which is application dependent. Refer to appropriate documentation for further information.

3.3 Reset Switch

This switch provides the capability to force a reset of the system.

3.4 PC Watchdog Timer

The ThinkIO-Duo provides a Watchdog Timer implemented in board logic. Before enabling the timer, the timing interval (timeout period) and operational mode must be configured. The time-out period can be programmed within the range of 125 msec to 256 sec in twelve steps. Four operational modes are available: timer only, reset, interrupt, and dual mode. Once enabled, the timer can only be disabled by a system reset or cold start. During the timing period, the timer must be reset (retriggered) before it times out. This is a function of the application software.

What transpires when a timeout occurs depends on the operational mode selected. Failure to retrigger the Watchdog Timer in time can result in a: timeout indication, a system reset, an interrupt being generated, or in dual mode, an automatic retrigger of the timer and an interrupt is generated by the first timeout and by the second consecutive timeout, the system is reset. A hardware status flag is provided to determine if the Watchdog timer generated the reset.

Each operating system is provided with a board support package (BSP) which contains the software for operating the PC Watchdog Timer. For further information, refer to the online documentation provided with the BSP.

3.5 PLC Watchdog Timer

In addition to the CPU related Watchdog Timer with its interrupt and reset capabilities there is a second IO related Watchdog Timer. This timer behaves similar to the PC timer except that it cannot force a reset or interrupt. Its output is via relay contacts. The timer is in the “On” state as soon as it is configured and enabled. It must be retriggered periodically within its programmable timeout period. Once it reaches timeout, it switches back to the “Off” state. The PLC Watchdog Timer cannot be re-enabled again until the next hard reset occurs.

The PLC Watchdog Timer has the same programming model as the PC Watchdog Timer with the following limitation: the operating mode is fixed to “Timer Only”.

The PLC Watchdog output directly controls a relay which provides an electrically isolated switch to the application.

Each operating system is provided with a board support package (BSP) which contains the software for operating the PLC Watchdog Timer. For further information, refer to the online documentation provided with the BSP.

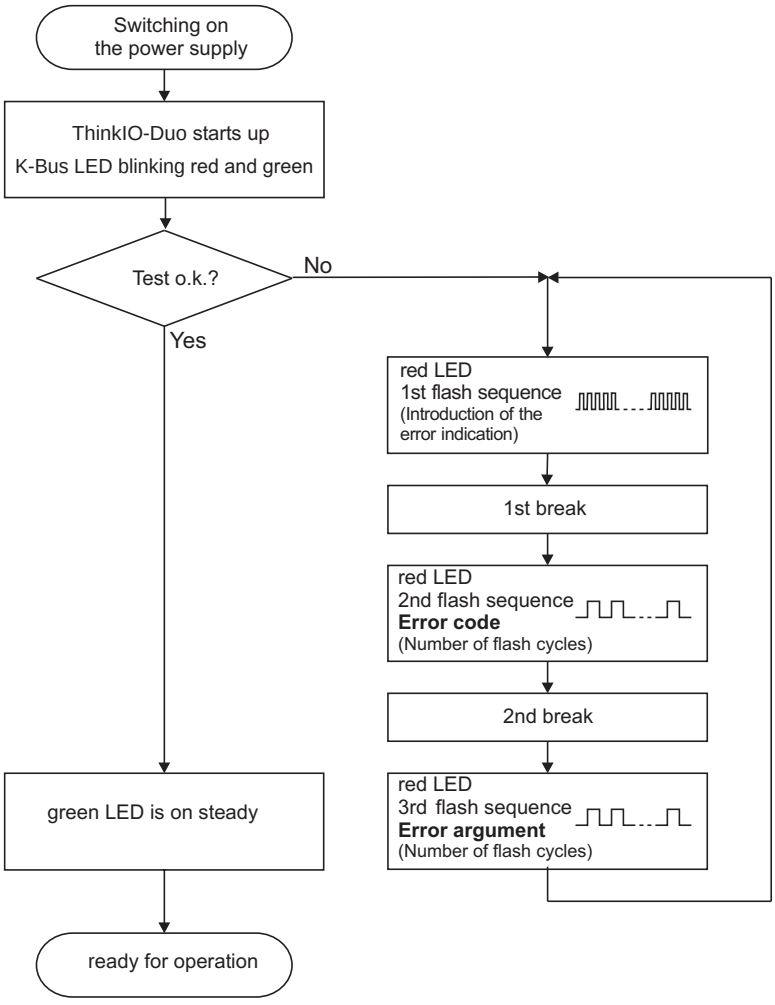
3.6 K-Bus Operational Status LED

The K-Bus LED displays the operational status of the internal K-Bus. In addition, this LED is used to display fault codes (blink codes) in the event of a system error. The K-Bus LED is a dual color red/green LED. Only one color can be displayed at a time.

Table 3-2: K-Bus LED Basic States

STATE	DESCRIPTION
FLASHING RED/GREEN	ThinkIO-Duo is starting up
FLASHING RED	During startup; the K-Bus is being initialized
ON GREEN	The ThinkIO-Duo is operating properly
FLASHING RED SEQUENCES	After startup, this LED is used to indicate that some error has occurred. In this case, the RED LED flashes according to a pre-determined coded sequence to indicate the type of error which occurred

Figure 3-1: Control Logic for the K-Bus LED



3.6.1 Blink Codes for the K-Bus LED

In the event an error occurs, the K-Bus LED provides coded information to determine what type of fault has been detected.

- the first blink sequence (approximately 10 Hz) starts the fault display
- the second blink sequence (approximately 1 Hz) followed by a pause indicates the fault code number as determined by the number of blinks
- the third blink sequence (approximately 1 Hz) followed by a pause indicates the fault argument code number as determined by the number of blinks

The following tables provide fault information whereby fault codes 2, 7, and 8 are not used.

Table 3-3: Fault Code 1: Hardware and Configuration Fault

ARGUMENT	DESCRIPTION	REMEDY
-	Invalid ThinkIO-Duo parameter checksum	Turn off the power supply of the node, replace the ThinkIO-Duo and turn the power supply on again.
1	Internal buffer overflow during inline code generation	Turn off the power supply of the node, reduce number of I/O modules and turn the power supply on again. If the error still exists, replace the ThinkIO-Duo.
2	I/O module(s) with unsupported data type	Detect faulty I/O module as follows: • turn off the power supply, place the end module in the middle of the node • turn the power supply on again • if the LED is still blinking, turn off the power supply and place the end module in the middle of the first half of the node (towards the ThinkIO-Duo) • if the LED doesn‘t blink, turn off the power supply and place the end module in the middle of the second half of the node (away from the ThinkIO-Duo) • turn the power supply on again • repeat this procedure until the faulty I/O module is detected • replace the faulty I/O module.
3	Unknown module type of flash program memory	Turn off the power supply of the node, replace the ThinkIO-Duo and turn the power supply on again.
4	Error occurred when writing to flash memory	Turn off the power supply of the node, replace the ThinkIO-Duo and turn the power supply on again.
5	Error occurred when erasing flash sector	Turn off the power supply of the node, replace the ThinkIO-Duo and turn the power supply on again.
6	The I/O module configuration after a K-Bus reset (AUTORESET) differs from the one after the last ThinkIO-Duo boot-up.	Restart the ThinkIO-Duo by turning the power supply off and on again.
7	Error occurred when writing to serial EEPROM	Turn off the power supply of the node, replace the ThinkIO-Duo and turn the power supply on again.

Table 3-3: Fault Code 1: Hardware and Configuration Fault

ARGUMENT	DESCRIPTION	REMEDY
8	Invalid hardware/firmware combination	Turn off the power supply of the node, replace the ThinkIO-Duo and turn the power supply on again.
9	Invalid check sum in serial EEPROM	Turn off the power supply of the node, replace the ThinkIO-Duo and turn the power supply on again.
10	Initialization of serial EEPROM failed	Turn off the power supply of the node, replace the ThinkIO-Duo and turn the power supply on again.
11	Error occurred with read access to serial EEPROM	Turn off the power supply of the node, reduce number of I/O modules and turn the power supply on again.
12	Time limit exceeded for accessing the serial EEPROM	Turn off the power supply of the node, replace the ThinkIO-Duo and turn the power supply on again.
14	Maximum number of Gateway or Mailbox I/O modules exceeded	Turn off the power supply of the node, reduce number of Gateway or Mailbox I/O modules and turn the power supply on again.

Table 3-4: Fault Code 3: Internal Bus Protocol Fault

ARGUMENT	DESCRIPTION	REMEDY
-	K-Bus communication malfunction; faulty device can't be detected	If the node comprises internal system supply modules (750-613), make sure first that the power supply of these modules is functioning. This is indicated by the status LEDs. If all I/O modules are connected correctly or if the node doesn't comprise 750-613 modules detect the faulty I/O module as follows: • turn off the power supply, place the end module in the middle of the node • turn the power supply on again • if the LED is still blinking, turn off the power supply and place the end module in the middle of the first half of the node (towards the ThinkIO-Duo) • if the LED doesn't blink, turn off the power supply and place the end module in the middle of the second half of the node (away from the ThinkIO-Duo) • turn the power supply on again • repeat this procedure until the faulty I/O module is detected, or if no faulty module is detected, replace the ThinkIO-Duo • replace the faulty I/O module

Table 3-5: Fault Code 4: Internal Bus Physical Fault

ARGUMENT	DESCRIPTION	REMEDY
-	Error in K-Bus data communication or interruption of the internal bus at the ThinkIO-Duo	Turn off the power supply of the node. Place an I/O module with process data behind the ThinkIO-Duo and note the error argument after the power supply is turned on. If no error argument is given by the K-Bus LED, replace the ThinkIO-Duo. Otherwise, detect the faulty I/O module as follows: • turn off the power supply, place the end module in the middle of the node • turn the power supply on again • if the LED is still blinking, turn off the power supply and place the end module in the middle of the first half of the node (towards the ThinkIO-Duo) • if the LED doesn't blink, turn off the power supply and place the end module in the middle of the second half of the node (away from the ThinkIO-Duo) • turn the power supply on again • repeat this procedure until the faulty I/O module is detected, or if no faulty module is detected, replace the ThinkIO-Duo • replace the faulty I/O module
n*	Interruption of the internal bus after the n-th process data module (* The number of argument blink pulses indicates the position of the IO module, whereby, modules without data are not counted, e.g. supply module without diagnosis.)	Turn off the power supply of the node, exchange the (n+1)-th process data module and turn the power supply on again.

Table 3-6: Fault Code 5: Internal Bus Initialization Fault

ARGUMENT	DESCRIPTION	REMEDY
n*	Error in register communication during K-Bus initialization (* The number of argument blink pulses indicates the position of the IO module, whereby, modules without data are not counted, e.g. supply module without diagnosis.)	Turn off the power supply of the node, replace the (n+1)-th process data module and turn the power supply on again.

Table 3-7: Fault Code 6: Design Error in Node Configuration

ARGUMENT	DESCRIPTION	REMEDY
5	Maximum size of process image exceeded	Turn off the power supply of the node, reduce the number of I/O modules and turn the power supply on again.

Table 3-8: Fault Code 9: CPU Exception Fault

ARGUMENT	DESCRIPTION	REMEDY
1	Invalid program instruction	Program sequence malfunction. Please contact the Kontron technical support
2	Stack overflow	Program sequence malfunction. Please contact the Kontron technical support
3	Stack underflow	Program sequence malfunction. Please contact the Kontron technical support
4	Invalid event (NMI)	Program sequence malfunction. Please contact the Kontron technical support

Table 3-9: Fault Code 10: Program Fault

ARGUMENT	DESCRIPTION	REMEDY
1	Invalid offset address for digital inputs	Correct the offset address in the appropriate function block
2	Invalid offset address for digital outputs	Correct the offset address in the appropriate function block

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