User's Guide

Beckhoff CTNet I/O

Remote I/O for CT Net

Part Number: 0485-0019
Issue Number: 1

Safety Information

Persons supervising and performing the electrical installation or maintenance of a Drive and/or an external Option Unit must be suitably qualified and competent in these duties. They should be given the opportunity to study and if necessary to discuss this User Guide before work is started.

The voltages present in the Drive and external Option Units are capable of inflicting a severe electric shock and may be lethal. The Stop function of the Drive does not remove dangerous voltages from the terminals of the Drive and external Option Unit. Mains supplies should be removed before any servicing work is performed.

The installation instructions should be adhered to. Any questions or doubt should be referred to the supplier of the equipment. It is the responsibility of the owner or user to ensure that the installation of the Drive and external Option Unit, and the way in which they are operated and maintained complies with the requirements of the Health and Safety at Work Act in the United Kingdom and applicable legislation and regulations and codes of practice in the UK or elsewhere.

The Drive software may incorporate an optional Auto-start facility. In order to prevent the risk of injury to personnel working on or near the motor or its driven equipment and to prevent potential damage to equipment, users and operators, all necessary precautions must be taken if operating the Drive in this mode.

The Stop and Start inputs of the Drive should not be relied upon to ensure safety of personnel. If a safety hazard could exist from unexpected starting of the Drive, an interlock should be installed to prevent the motor being inadvertently started.

General Information

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation or adjustment of the optional operating parameters of the equipment or from mismatching the Drive with the motor.

The contents of this User Guide are believed to be correct at the time of printing. In the interests of a commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or its performance, or the contents of the User Guide, without notice.

Author: PB
Issue Code: 1
Software Version: SYPT V1.01.02
Firmware Version: BK7200 V1.00

Contents

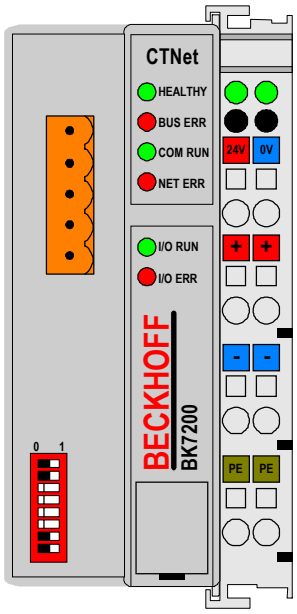
1 Introduction

1.1 Remote I/O for CTNet

The BK7200 provides an interface that allows the Beckhoff modular I/O system to be connected to CTNet networks. This interface is called a “bus coupler”, and allows any combination of input and output terminals to be connected to it. It mounts directly onto the standard DIN rail, making installation both quick and easy.

The new BK7200 CTNet Bus Coupler module is the interface between CTNet and the Beckhoff serial K-bus, and acts as a buffer for information transfer between the two bus systems. A range of digital and analogue I/O terminals are supported by the CTNet Bus Coupler.

1.2 BK7200 Bus Coupler



The main building block for creating an I/O point on CTNet is the BK7200 CTNet Bus Coupler. This module connects directly to the CTNet network, and appears on the network as another node. The data rate is selectable from 5.0 Mbits/sec to 625 Kbits/sec, and is configured (along with the node address) using the DIP switches

The BK7200 supports both fast and slow cyclic data, and non-cyclic data commands. Although the BK7200 can respond to non-cyclic read and write commands issued by other nodes on the network, it cannot initiate non-cyclic commands, as it does not support DPL code. The SYPT Workbench software package (V1.01.02 or later) is required to configure cyclic data links within the BK7200 module.

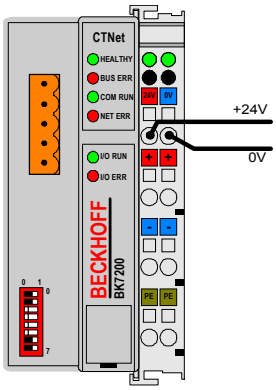
Terminals are addressed using the same menu and parameter structure (#MM.PP) as the Control Techniques Unidrive and Mentor II products. Each terminal is assigned to a menu according to the type of terminal it is, with the

parameter number determined by the physical position of the terminal with respect to other similar terminals. This allows additional terminals to be connected at a later date without affecting the existing terminal configuration.

Digital inputs and outputs are addressed in blocks of 16 bits. This provides an efficient method of transferring digital input and output information around the system without taking up large amounts of the available network bandwidth.

2 Electrical Installation

2.1 BK7200 Main Power Supply Requirements



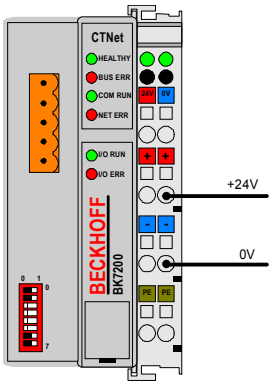
The BK7200 requires a regulated +24V DC power supply, which is connected via the topmost spring terminals, labelled “24V” and “0V”. This supplies the main bus coupler and the serial K-bus. The power supply of the bus coupler circuitry and that of the K bus are electrically isolated from CTNet.

Nominal Supply Current: 50mA at 24V

This value defines the current required only for the BK7200 bus coupler itself. This does not include any power supply requirements for terminal modules via the K-bus.

The current consumption from the K-bus is specified in the Beckhoff data sheets for each terminal module. Once the required configuration of terminals is known, the total current requirements for the bus coupler and K-bus can be calculated.

2.2 Power Supply to the Power Contacts



The six lower connections with spring terminals can be used to supply power to the peripherals. The spring terminals are connected in pairs to the power contacts. The power supply to the power contacts has no connection to the power supply of the bus coupler.

The power contacts rated for a maximum continuous load of 10A with a +24V DC power supply. This can be connected directly to the supply for the bus coupler itself, provide the power supply can handle the current requirement for all terminal blocks.

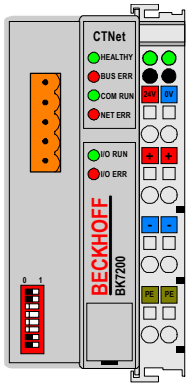
The power supply requirements for the power contacts depends entirely on the load current drawn from the power contacts by each output.

2.3 Supply isolation

The bus coupler operates with three independent supplies. The input power supplies the electrically isolated K-bus control circuits in the bus coupler, and the K-bus itself. The power supply is also used to generate the operating voltages for CTNet. All bus terminals are electrically isolated from the K bus, so that the K bus is fully isolated electrically.

3 CTNet Installation

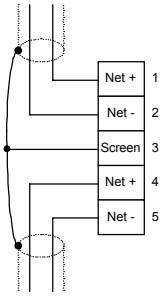
3.1 BK7200 Bus Coupler



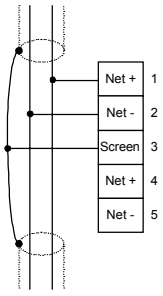
The BK7200 has a single CTNet connector, with the pin out connections as follows:-

Function	CTNet	Description
Net +	1,4	Positive data line
Net -	2,5	Negative data line
Screen	3	Cable screen

All three connections **including the cable screen** must be connected using one of the methods shown below:



Method 1



Method 2

Pins 1 and 4 are connected via the internal PCB, as are pins 2 and 5. The CTNet interface uses Bi-Phase S signalling which is non-phasic, so it does not matter which wire is linked to Net+ and Net-.

Method 1 allows for easy installation by only having a single wire connected to each terminal. Since the Net+ and Net- pins are connected on the internal PCB, it is not necessary to have the bus coupler powered up for the rest of the network to operate. However, if the connector is physically disconnected from the module, this will break the network connection.

Method 2 overcomes the problem of breaking the network in case of disconnection, but it does mean that two wires have to be connected into each terminal. In most cases, this type of connection is not necessary.

3.2 Cable Specification

For maximum noise immunity, special CTNet cable must be used. This is particularly important in CTNet networks operating at the higher data rates or 5.0 or 2.5 Mbits/sec.

Customised CTNet cable is available from your local Control Techniques Drive Centre, and it is strongly recommended that this cable is used in all CTNet installations.

3.3 Cable Screen

The screen of the cable at every node on the network MUST be connected to the screen terminal (pin 3) on the CTNet terminal block. When the screen is stripped back to connect the twisted pair to the CTNet terminals, keep the exposed section of the cable as short as possible.

3.4 Network Termination

The network **MUST** be fitted with terminating resistors **AT BOTH ENDS!!!** If resistors are not fitted, the network may appear to work OK, but the noise immunity of the network will be drastically reduced. The terminating resistor value should match the nominal characteristic impedance value for the cable; in the case of the customised CTNet cable, the terminating resistors used should be 78Ω ±5%.

NOTE

75Ω ±1% resistors may be used, as 78Ω is not a standard resistor value.

3.5 Network Limitations

The BK7200 is capable of driving a maximum of 15 nodes over a maximum network cable length of 100m at 5.0 Mbits/sec. If the network data rate is reduced to 2.5 Mbits/sec, the maximum network length is increased to 200m, but the limit of 15 nodes remains the same.

3.5.1 Network Repeaters

If the combination of network length and number of nodes for a given network data rate cannot be met with a single trunk connection, line repeaters can be used to extend the network. (See Section 3.5, page 6, "Network Limitations".)

A line repeater will allow another section of cable, but it is only capable of driving 10 nodes. Any section of the network that will be driven by a repeater is limited to 9 nodes plus repeater, or 8 nodes plus 2 repeaters. Line termination resistors must be fitted at the end of each section of cable.

3.5.2 PC ISA and PCMCIA Cards

PC ISA and PCMCIA cards are limited to driving 6 nodes. Any section containing a link to a PC interface is limited to 5 nodes plus PC card, or 4 nodes, PC card plus a repeater.

Ideally, any connection to a PC should be made via a repeater or active hub, so as to keep the PC interface card separate from the rest of the network. This allows a PC to be connected and disconnected as required, without affecting the “permanent” section of the network.

3.5.3 Mixed Networks

In a mixed network, the network limitations for any network segment are determined by the module with the lowest network capabilities. This especially applies when network repeaters, PC ISA and PCMCIA cards are used.

4 Getting Started

The DIP switches on the BK7200 are used to specify the node address and the data rate. These links should be set as required before the module is powered up.

4.1 Network Node Address

Each node on the network must have a unique node address assigned. This is set using DIP switches 1 to 6 on the BK7200. The range of addresses for the bus coupler is limited from 1 to 64.

Node	DIP Switch						Node	DIP Switch						Node	DIP Switch					
Address	6	5	4	3	2	1	Address	6	5	4	3	2	1	Address	6	5	4	3	2	1
1	0	0	0	0	0	0	23	0	1	0	1	1	0	45	1	0	1	1	0	0
2	0	0	0	0	0	1	24	0	1	0	1	1	1	46	1	0	1	1	0	1
3	0	0	0	0	1	0	25	0	1	1	0	0	0	47	1	0	1	1	1	0
4	0	0	0	0	1	1	26	0	1	1	0	0	1	48	1	0	1	1	1	1
5	0	0	0	1	0	0	27	0	1	1	0	1	0	49	1	1	0	0	0	0
6	0	0	0	1	0	1	28	0	1	1	0	1	1	50	1	1	0	0	0	1
7	0	0	0	1	1	0	29	0	1	1	1	0	0	51	1	1	0	0	1	0
8	0	0	0	1	1	1	30	0	1	1	1	0	1	52	1	1	0	0	1	1
9	0	0	1	0	0	0	31	0	1	1	1	1	0	53	1	1	0	1	0	0
10	0	0	1	0	0	1	32	0	1	1	1	1	1	54	1	1	0	1	0	1
11	0	0	1	0	1	0	33	1	0	0	0	0	0	55	1	1	0	1	1	0
12	0	0	1	0	1	1	34	1	0	0	0	0	1	56	1	1	0	1	1	1
13	0	0	1	1	0	0	35	1	0	0	0	1	0	57	1	1	1	0	0	0
14	0	0	1	1	0	1	36	1	0	0	0	1	1	58	1	1	1	0	0	1
15	0	0	1	1	1	0	37	1	0	0	1	0	0	59	1	1	1	0	1	0
16	0	0	1	1	1	1	38	1	0	0	1	0	1	60	1	1	1	0	1	1
17	0	1	0	0	0	0	39	1	0	0	1	1	0	61	1	1	1	1	0	0
18	0	1	0	0	0	1	40	1	0	0	1	1	1	62	1	1	1	1	0	1
19	0	1	0	0	1	0	41	1	0	1	0	0	0	63	1	1	1	1	1	0
20	0	1	0	0	1	1	42	1	0	1	0	0	1	64	1	1	1	1	1	1
21	0	1	0	1	0	0	43	1	0	1	0	1	0							
22	0	1	0	1	0	1	44	1	0	1	0	1	1							

4.2 Network Data Rate

Each node on the network must be configured to run at the same data rate. This is set using DIP switches 7 and 8 on the BK7200. The data rates available for on the BK7200 range from 5.0 Mbits/sec to 625 Kbits/sec. (312.5 Kbits/sec is not supported.)

The maximum data rate that can be supported depends on the total length of cable in the network, and the number of nodes connected to the network. (See Section 3.5, page 6, "Network Limitations".)

Data Rate (bits/sec)	DIP 7	DIP 8
5.0M	0	0
2.5M	1	0
1.25M	0	1
625K	1	1

4.3 Synchronisation Message

The cyclic data synchronisation message cannot the generated by the BK7200. To use cyclic data, this message MUST be generated by a Unidrive or Mentor II node on the network.

4.4 Network Initialisation Failure

There are several rules that must be satisfied for the network to initialise correctly.

- All nodes must have a unique node address.
- All nodes must have the same data rate setting.
- Only one node must be set to generate the synchronisation message.

4.5 Network Loss

If the CTNet network connection to a BK7200 node is lost for any reason, this will be indicated by NET ERR light. The module will automatically re-join the network when the network is re-connected to the bus coupler.

4.6 Network Interruptions

If power is lost to a BK7200 node, this does not prevent the network from continuing, or being re-started without the “dead” node. (Other nodes may re-configure to ignore the “dead” node.) Both NET+ terminals are linked via the BK7200 module, as are the NET- pins, so the network is not physically broken. If a bus coupler is physically removed from the system, one of two precautions must be taken to avoid breaking the network:

- The network lead must be left connected to the BK7200.
- The Net+ and Net- wires for each cable must be wired into the same terminal on the CTNet connector.

5 Terminal Configuration

As the terminal blocks are connected together, each terminal is connected onto the serial K-bus. The BK7200 bus coupler scans the K-bus during initialisation, starting with the terminal block nearest to the bus coupler, and checks the ID code. This is repeated for each subsequent terminal connected to the bus. A “database” is built up within the internal memory, which contains a complete image of the status of the input and output terminals. The database acts as a buffer between CTNet and the K-bus, with both systems allowed to read and write data to and from the database.

The database is structured as a two dimensional array, in a similar way to the internal parameter sets of the Unidrive and Mentor II. Menu and parameter references are used to address each location within the database.

During initialisation, the bus coupler scans the terminal configuration via the K-bus, starting with the terminal nearest to the bus coupler. It checks the ID code of each terminal, and builds up the database for every input and output terminal connected. Each terminal is assigned to a particular pre-defined menu, depending on the type of terminal it is. This means that digital inputs are all grouped together under one menu, and the same applies for digital outputs, analogue inputs, analogue outputs, etc.

The parameter reference for each terminal is assigned on a sequential basis. As each new terminal is found, it is assigned the next unused parameter location in the appropriate menu. This process continues to build the database, until all terminals have been assigned to the database.

5.1 BK7200 Bus Coupler

Combinations of modules may be connected to the BK7200 module, subject to certain limitations:

1. The maximum limit of 64 terminal blocks is not exceeded.
2. No more than 100 analogue input terminals are connected to a single CTNet bus coupler.
3. No more than 100 analogue output terminals are connected to a single CTNet bus coupler.

5.2 Digital Inputs

Digital inputs assigned to parameters in menu 1. A maximum of 256 digital inputs can be connected to a single bus coupler. All digital input parameters are read only. Terminals cannot be addressed individually, but each group of 16 inputs can be read using non-cyclic data commands.

b31	b30	b29	b28	b27	b26	b25	b24	b23	b22	b21	b20	b19	b18	b17	b16

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
T15	T14	T13	T12	T11	T10	T9	T8	T7	T6	T5	T4	T3	T2	T1	T0

Each parameter contains the data from 16 digital inputs terminals. CTNet actually transfers data as 32-bit words, but the upper 16 bits are not used when reading digital inputs. If there are insufficient terminals to utilise all the bits in a parameter, the other bits will be reset to 0.

Reference	I/O Points	Reference	I/O Points
#1.00	T0 - T15	#1.08	T128 - T143
#1.01	T16 - T31	#1.09	T144 - T159
#1.02	T32 - T47	#1.10	T160 - T175
#1.03	T48 - T63	#1.11	T176 - T191
#1.04	T64 - T79	#1.12	T192 - T207
#1.05	T80 - T95	#1.13	T208 - T223
#1.06	T96 - T111	#1.14	T224 - T239
#1.07	T112 - T127	#1.15	T240 - T255

5.2.1 Supported Terminals

The bus terminal blocks listed in the table below are all classed as “Digital Input Terminals”, and are all assigned to parameters in menu 1.

Type	Inputs	Description
KL1002	2	24V DC, filter 3.0 ms
KL1012	2	24V DC, filter 0.2 ms
KL1032	2	48V DC, filter 3.0 ms
KL1052	2	24V DC, filter 3.0 ms, with P/N switching
KL1104	4	24V DC, filter 3.0 ms
KL1114	4	24V DC, filter 0.2 ms
KL1124	4	5V DC, filter 0.2ms
KL1154	4	24V DC, filter 3.0 ms, with P/N switching
KL1164	4	24V DC, filter 0.2 ms, with P/N switching
KL1184	4	24V DC, filter 3.0 ms, with N switching
KL1702	2	230V AC
KL1712	2	120V AC/DC
KL1722	2	230V AC, no power contacts

There are other terminals available within the Beckhoff range, but these are not supported in bus couplers fitted with V1.00 firmware. They will be supported in future versions of firmware.

5.3 Digital Outputs

Digital outputs are assigned to parameters in menu 2. All digital output parameters are read/write A maximum of 256 digital inputs can be connected to a single bus coupler. only. Terminals cannot be addressed individually, but each group of 16 outputs can be written to or read from using non-cyclic data commands.

b31	b30	b29	b28	b27	b26	b25	b24	b23	b22	b21	b20	b19	b18	b17	b16
M15	M14	M13	M12	M11	M10	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
T15	T14	T13	T12	T11	T10	T9	T8	T7	T6	T5	T4	T3	T2	T1	T0

Digital outputs are controlled in groups of 16 bits, with the upper 16 bits of the 32-bit word acting as “mask bits”. Mask bits determine whether the corresponding data bit is actually written into the database. This allows different nodes to address the same block of digital outputs, and only update certain outputs. If a mask bit is set to 1, the corresponding data bit will be updated in the database. If a mask bit is set to 0, the corresponding data bit is NOT updated in the database.

Reference	I/O Points	Reference	I/O Points
#2.00	T0 - T15	#2.08	T128 - T143
#4.01	T16 - T31	#2.08	T144 - T159
#2.02	T32 - T47	#2.09	T160 - T175
#2.03	T48 - T63	#2.10	T176 - T191
#2.04	T64 - T79	#2.11	T192 - T207
#2.05	T80 - T95	#2.12	T208 - T223
#2.06	T96 - T111	#2.13	T224 - T239
#2.07	T112 - T127	#2.14	T240 - T255

5.3.1 Supported Terminals

The bus terminal blocks listed in the table below are all classed as “Digital Output Terminals”, and are all assigned to parameters in menu 2.

Terminal	Outputs	Description
KL2012	2	24V DC, 0.5A
KL2022	2	24V DC, 2.0A
KL2032	2	48V DC, 0.5A, with polarity protection
KL2114	4	24V DC, 0.5A
KL2124	4	5V DC
KL2134	4	24V DC, 0.5A, with polarity protection
KL2184	4	24V DC, 0.5A, with N switching
KL2602	2	Relay outputs, 230V AC, 2A, normally open

Terminal	Outputs	Description
KL2612	2	Relay outputs, 125V AC, 0.5A, changeover
KL2622	2	Relay outputs, 230V AC, 0.5A, isolated normally open
KL2631	1	Relay output, 400V AC, 3A normally open
KL2702	2	Solid state outputs, 230V AC, 0.3A

5.4 Analogue Inputs

Analogue inputs assigned to menu 3. A maximum of 100 analogue inputs can be connected to a single bus coupler. All parameters are read only.

Reference	I/O Point
#3.00	0
#3.01	1
#3.02	2
#3.xx	xx
#3.98	98
#3.99	99

5.4.1 Supported Terminals

The bus terminal blocks listed in the table below are all classed as "Analogue Input Terminals", and are all assigned to parameters within menu 3.

Terminal	Inputs	Description
KL3002	2	±10V, differential inputs
KL3012	2	0-20mA, differential inputs
KL3022	2	4-20mA, differential inputs
KL3042	2	0-20mA, power supply for transducers via power contacts
KL3052	2	4-20mA, power supply for transducers via power contacts
KL3062	2	±10V, single-ended inputs
KL3064	4	±10V, single-ended inputs

The resolution of all voltage inputs is 11 bits for unipolar inputs, and 11 bits plus sign for bipolar inputs. All current inputs have a resolution of 12 bits.

All inputs are scaled where minimum input is 0, and maximum input is 32767. For a bipolar input, -10V will return -32768.

Input Range	Minimum Input	Maximum Input	Resolution
0-10V	0V = 0	+10V = 32767	5mV
±10V	-10V = -32768	+10V = 32767	5mV
0-20mA	0mA = 0	20mA = 32767	5μA
4-20mA	4mA = 0	20mA = 32767	4μA

5.5 Analogue Outputs

Analogue outputs are assigned to menu 4. A maximum of 100 analogue outputs can be connected to a single bus coupler. All parameters are write only.

Reference	I/O Point
#4.00	0
#4.01	1
#4.02	2
#4.xx	xx
#4.98	98
#4.99	99

5.5.1 Supported Terminals

The bus terminal blocks listed in the table below are all classed as "Analogue Output Terminals", and are all assigned to parameters within menu 31, menu 32 or menu 33 in the database.

Terminal	Inputs	Description
KL4002	2	0 -10V DC
KL4012	2	0-20mA
KL4022	2	4-20mA
KL4032	2	±10V DC

The resolution of all voltage outputs is 11 bits for unipolar inputs, and 11 bits plus sign for bipolar inputs. All current outputs have a resolution of 12 bits.

All outputs are scaled where 0 produces the minimum output, and 32767 produces the maximum output. For a bipolar output, -32768 will give -10V output.

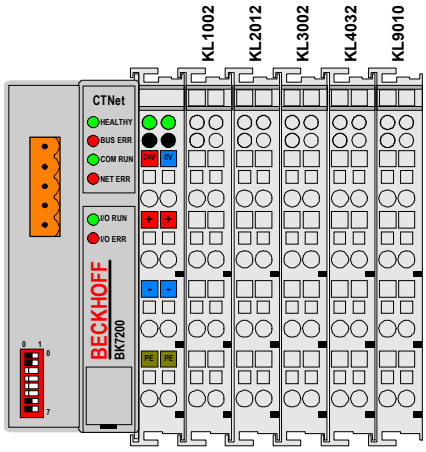
Output Range	Minimum Output	Maximum Output	Resolution
0-10V	0 = 0V	32767 = +10V	5mV
±10V	-32768 = -10V	32767 = +10V	5mV
0-20mA	0 = 0mA	32767 = 20mA	5μA
4-20mA	0 = 4mA	32767 = 20mA	4μA

5.6 Complex Terminals

Complex terminals, such as pulse counters, encoder interfaces and serial communications interfaces are not supported by V1.00 firmware. These terminals will be supported in later versions of firmware.

5.7 Example Configuration 1

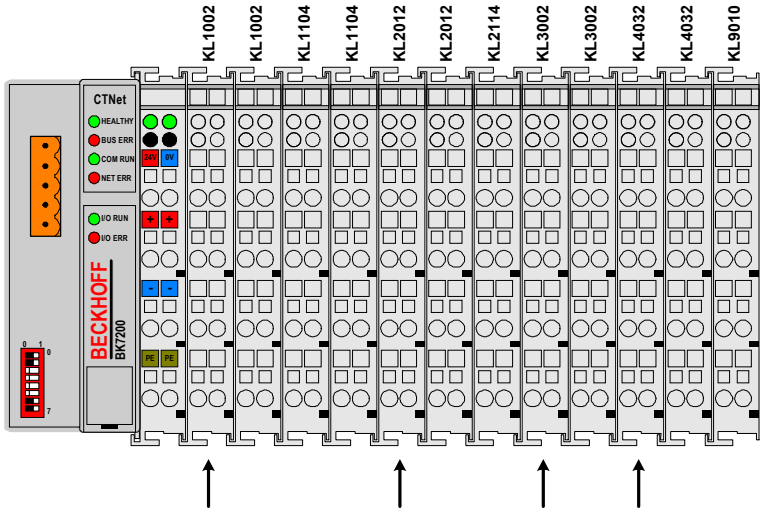
The configuration shown below provides 2 digital inputs and outputs, plus 2 analogue inputs and outputs. The table shows the parameters which can be accessed to read the status of the input terminals, or update the status of the output terminals.



Terminal	Terminal Function	Parameter Reference
1	Digital Input 0	#1.00 b0
1	Digital Input 1	#1.00 b1
2	Digital Output 0	#2.00 b0
2	Digital Output 1	#2.00 b1
3	Analogue Input 0	#3.00
3	Analogue Input 1	#3.01
4	Analogue Output 0	#4.00
4	Analogue Output 1	#4.01
5	K-Bus Terminator	

5.8 Example Configuration 2

The configuration in example 1 has been extended to provide 12 digital inputs and 8 digital outputs, plus 4 analogue inputs and outputs. The arrows indicate the new positions of the terminals used in example 1. The table shows the parameters which have been assigned to the can be accessed to read the status of the input terminals, or update the status of the output terminals.



KLxx xx	Input/Output Function	Parameter Reference		KLxx xx	Input/Output Function	Parameter Reference
1	Digital Input 0	#1.00 b0		6	Digital Output 2	#2.00 b2
1	Digital Input 1	#1.00 b1		6	Digital Output 3	#2.00 b3
2	Digital Input 2	#1.00 b2		7	Digital Output 4	#2.00 b4
2	Digital Input 3	#1.00 b3		7	Digital Output 5	#2.00 b5
3	Digital Input 4	#1.00 b4		7	Digital Output 6	#2.00 b6
3	Digital Input 5	#1.00 b5		7	Digital Output 7	#2.00 b7
3	Digital Input 6	#1.00 b6		8	Analogue Input 0	#3.00
3	Digital Input 7	#1.00 b7		8	Analogue Input 1	#3.01
4	Digital Input 8	#1.00 b8		9	Analogue Input 2	#3.02
4	Digital Input 9	#1.00 b9		9	Analogue Input 3	#3.03
4	Digital Input 10	#1.00 b10		10	Analogue Output 0	#4.00
4	Digital Input 11	#1.00 b11		10	Analogue Output 1	#4.01
5	Digital Output 0	#2.00 b0		11	Analogue Output 2	#4.02
5	Digital Output 1	#2.00 b1		11	Analogue Output 3	#4.03

Digital inputs and outputs should be grouped together, as they need to have power supplied through the power contacts to drive external relays, etc. Voltage output analogue modules do not use the power contacts, so they should be placed at the end of the line of terminals.

When the terminal and parameter mappings are compared with example 1, it can be seen that the original terminals (marked with arrows in the diagram) are still assigned to the parameters.

It can be seen that the digital input and output terminals have been fitted BEFORE the analogue terminals. However, this does not affect the addressing of the analogue input and output terminals. When the K-bus scans the terminals during initialisation to build up the internal database, although the analogue input terminal will now be the 8^h terminal to be found, it is still the 1^{st} analogue input terminal. Therefore, when it is entered into the database, both inputs will be assigned the first available parameter numbers in menu 3, which will still be 0 and 1. Hence, there is no change in the terminal address. As additional analogue input modules are added, they will get the next available numbers in menu 3.

5.9 Golden Rule

WHEN ADDING INPUT AND OUTPUT TERMINALS TO A BUS COUPLER, ENSURE THAT EACH TYPE OF INPUT IS ADDED **AFTER** THE LAST TERMINAL BLOCK OF A SIMILAR TYPE. THIS WILL ENSURE THAT ALL EXISTING TERMINAL AND PARAMETER MAPPINGS WILL **NOT** BE AFFECTED.

6 Cyclic Data

The SYPT Workbench package must be used to configure a BK7200 module to transmit cyclic data over the CTNet network. SYPT provides a graphical network configuration tool, which displays all configured cyclic links between nodes. This manual assumes that the user has a basic knowledge of using SYPT to configure CTNet networks. For more information, refer to the SYPT User Guide.

6.1 Fast and Slow Cyclic Data Channels

To configure cyclic data transfers, “data links” must be defined for both the fast and slow cyclic data channels. Each link is configured to transmit a defined set of consecutive registers or parameters from within a particular menu in the BK7200, to a defined set of consecutive registers or parameters in the target node. This is known as “binding” registers together.

There are two limitations when defining the cyclic data links to be transmitted, and the number of registers to be transmitted by the BK7200 module:

1. A maximum of 20 separate links can be defined for a single node. This total includes both fast and slow data links.
2. No individual link may transfer more than 20 consecutive registers.

Each link runs on successive token rotations. The first defined link is transmitted on the first token rotation after the “synchronisation message”, the next link on the next token rotation and so on.

6.2 Overloading Network Nodes

Care must be taken when configuring a network to ensure that the BK7200 does not get overloaded with incoming messages. The BK7200 is capable of processing up to 4 messages every millisecond. (4000 messages per second) If the module is overloaded with incoming messages, messages may be lost before they can be processed, and the cyclic data transfer may be corrupted. The number of messages arriving over CTNet can be monitored in #0.02 in the BK7200.

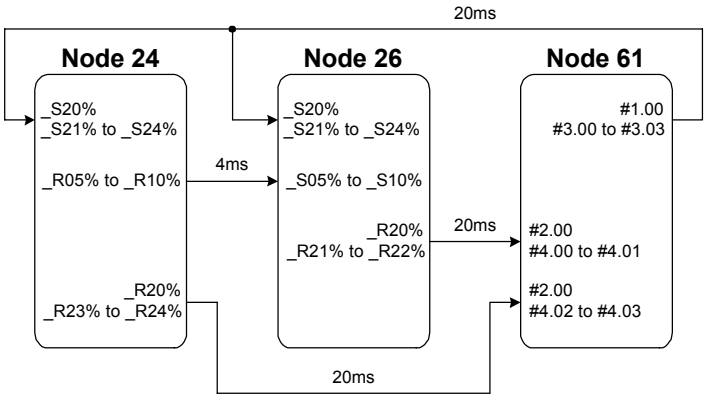
The terminal update time via the serial K-bus will decrease as the CTNet message loading increases, and this can be monitored in #0.03 in the BK7200. This means that the balance between CTNet cyclic data update and K-bus terminal update time depends on both the amount of CTNet messages to be processes, and the number of terminals connected to the coupler.

A good example where the BK7200 could become overloaded is when every node on the network is sending cyclic data to the BK7200. On a large network, say 50 drives, this can mean that the bus coupler suddenly receives 50 messages in very quick succession, cannot process them

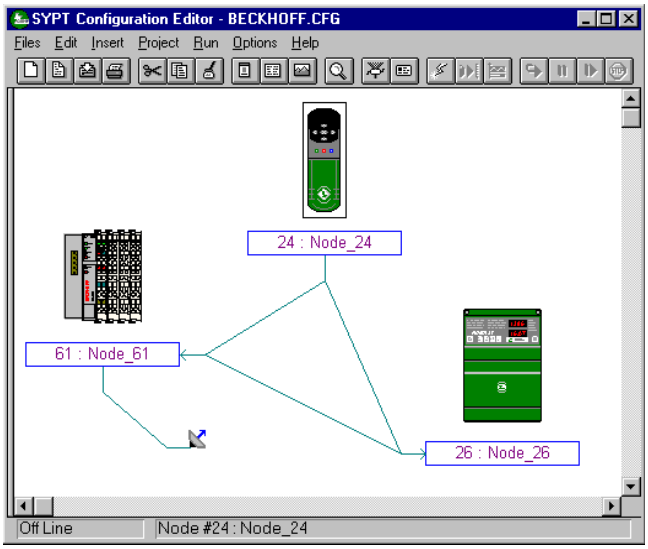
quickly enough, and loses some of the messages. The effect of the lost messages could indicate to the monitoring node that several drives are not functioning, when this is not actually the case, and all nodes are operating OK.

6.3 Example Network

As an example, consider the configuration of terminals connected to the BK7200 as shown in section 5.8, page 16, "Example Configuration 2". The diagram below shows a possible information transfer requirement for an application.



6.3.1 SYPT Configuration Editor

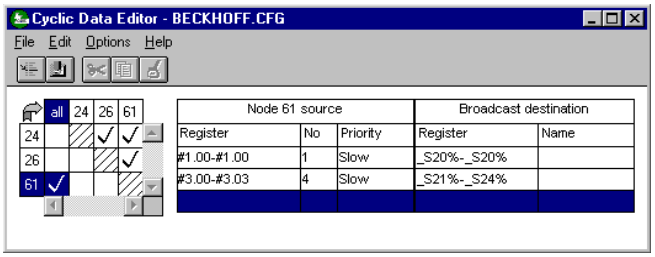


The SYPT Workbench software development tool (V1.01.02 or later) is required to configure cyclic data links from the BK7200 bus coupler. The picture above shows a typical view of the graphical configuration ,method used to configure the BK7200 on CTNet.

NOTE

If you have never used the SYPT Workbench, it is highly recommended that you attend a suitable training course to use the product, before attempting to configure a CTNet network.

6.3.2 SYPT Cyclic Data Editor



Once a link between nodes has been drawn, the data transfer requirements must be specified. When the BK7200 is the source of a cyclic data link, permissible source registers are #1.xx or #3.xx. This will pick up digital or analogue input information for transfer over the network.

The number of registers specified means that successive parameters within the menu will be sent over the network. The priority defines whether the data is transmitted as FAST or SLOW cyclic data.

The destination registers depends on the type of node to which the link is being written. For a Unidrive or Mentor II node, data must be sent to the _Sxx% registers. If the target node is another Beckhoff node, the destination parameters can be #2.xx or #4.xx.

7 Non-Cyclic Data

The non-cyclic data channel allows true “peer-to-peer” communications, where any node can access any parameter or virtual parameter from any other network node. This function is particularly useful for transmitting infrequent events around the network. The BK7200 cannot issue these commands as it does not run DPL programs, but it will respond to non-cyclic **RDNET**, **WRNET** and **CHECKNODE** commands issued by other nodes on the network.

A typical example where non-cyclic data may be used is on a large network for infrequent data, such as a switch to engage a pinch roller when the line is ready to start a production run. Response time to changing the switch is not critical, since it may take several seconds for the roller to engage. Once the roller is engaged, there is no need to transmit any information about the switch over the network until the switch changes. This provides a large reduction in the network bandwidth used for this signal, and increases the bandwidth available for other data signals. This offers a clear advantage over PLC-based systems where the main processor has to scan the switch continuously.

8 Diagnostics

8.1 Determining If Network Is Active

LED	Colour	Description
HEALTHY	Green	Indicates that the BK7200 module is healthy
BUS ERR	Red	The CTNet network has stopped operating. Equivalent to a -1 condition in #20.50 on Unidrive.
COM RUN	Green	Indicates that the BK7200 module is receiving messages over the CTNet network.
INIT ERR	Red	The CTNet interface has not initialised correctly. Equivalent to a -2 condition in #20.50 on Unidrive.
I/O RUN	Green	The serial K-bus that links the terminal blocks to the BK7200 is operating correctly.
I/O ERR	Red	An error has occurred in the serial K-bus.

8.2 Diagnostic Parameters

Menu 0 in the BK7200 module provides some status parameters to monitor the state and operation of the BK7200 bus coupler.

Parameter	Description
#0.01	Software Version. The version number (Vxx.yy) is encoded to produce this parameter value as (xx * 100) + yy
#0.02	CTNet network messages per second. This parameter is the equivalent of #20.50 on Unidrive.
#0.03	Beckhoff terminal K-Bus cycles per second. This parameter indicates how often the terminals will be updated by the K-bus.
#0.04 to #0.99	Reserved

8.3 Cannot Establish CTNet Connection

1 Ensure that the correct type of cable is used. CTNet runs at very high data rates, and consequently requires high quality cable. Performance cannot be guaranteed if the specified Control Techniques CTNet cable is not used.

2 Terminating resistors MUST be fitted. Unpredictable network behaviour may result, and the noise immunity of the network will also be severely reduced without proper line termination resistors. (75Ω ±1% resistors may be fitted, as 78Ω is not a standard resistor value.)

3 Ensure that the correct system files have been downloaded. These should be “UD70NET.SYS” for UD70 and “M2NET.SYS” for MD29AN, version V2.6.3 or later.

4 Check the node configuration settings on all nodes. Every node must have a unique node address, all node data rates must be identical, and only one drive must be set to generate the synchronisation message.

5 Ensure that the data rate selected is OK for the length of network cable installed. If necessary, try reducing the network data rate AT ALL NODES to establish communications. Repeaters may be required to extend the network length for a given data rate. See Section 3.5, page 6, "Network Limitations".

6 CTNet nodes are only capable of driving up to 15 nodes each. If more than 15 nodes are connected to a single section of cable, network repeaters will be required. Network repeaters affect the maximum number of nodes on each section of cable. See Section 3.5.1, page 7, "Network Repeaters".

7 On Mentor II, parameters #11.01 to #11.10 are used to configure CTNet, and cannot be used to define Menu 0. These parameters should all be set to 0 before the MD29AN card is installed. Existing parameter values may cause unexpected “easy mode” mappings of data to drive parameters.

9 Quick Reference

9.1 DIP Switch Set-up

Function	BK7200	Range	Comments
Node Address	DIP1 to DIP6	1 to 64	DIP1 sets the least significant bit of the node address. DIP6 sets the most significant bit.
Network Data Rate	DIP7 and DIP8	0 to 3	DIP7 sets the least significant bit of the data rate, DIP8 sets the most significant bit. 0 = 5.0 Mbits/sec 1 = 2.5 Mbits/sec 2 = 1.25 Mbits/sec 3 = 625 Kbits/sec

9.2 Status Parameters

Parameter	Description
#0.01	Software Version. The version number (Vxx.yy) is encoded to produce this parameter value as (xx * 100) + yy
#0.02	CTNet network messages per second. This parameter is the equivalent of #20.50 on Unidrive.
#0.03	Beckhoff terminal K-Bus cycles per second. This parameter indicates how often the terminals will be updated by the K-bus.
#0.04 to #0.99	Reserved

9.3 Status LEDs

LED	Colour	Description
HEALTHY	Green	Indicates that the BK7200 module is healthy
BUS ERR	Red	The CTNet network has stopped operating. Equivalent to a -1 condition in #20.50 on Unidrive.
COM RUN	Green	Indicates that the BK7200 module is receiving messages over the CTNet network.
INIT ERR	Red	The CTNet interface has not initialised correctly. Equivalent to a -2 condition in #20.50 on Unidrive.
I/O RUN	Green	The serial K-bus that links the terminal blocks to the BK7200 is operating correctly.
I/O ERR	Red	An error has occurred in the serial K-bus.

9.4 Terminal-Menu Assignments

Terminal Type	Menu	Description
Digital Input	#1.00 to #1.15	Up to 16 digital inputs are returned by each parameter. Parameters become available as terminals are added to the coupler. Up to 256 digital inputs can be connected to a single bus coupler.
Digital Output	#2.00 to #2.15	Up to 16 digital outputs are controlled by each parameter. Each output has a mask bit that must be set to 1 to write to the output. Parameters become available as terminals are added to the coupler. Up to 256 digital outputs can be connected to a single bus coupler.
Analogue Input	#3.00 to #3.99	Analogue inputs are scaled to return -32768 to +32767 at full scale input. Up to 100 analogue inputs can be connected to a single bus coupler.
Analogue Output	#4.00 to #4.99	Analogue outputs are scaled to give full scale output with values of -32768 and +32767. Up to 100 analogue outputs can be connected to a single bus coupler.

9.5 Supported Terminals

9.5.1 Firmware Version V1.00

The terminals listed in the tables below are all supported by BK7200 bus coupler modules that contain firmware version V1.00.

Digital Inputs		Digital Outputs	
KL1002	KL1154	KL2012	KL2184
KL1012	KL1164	KL2022	KL2602
KL1032	KL1184	KL2032	KL2612
KL1052	KL1702	KL2114	KL2622
KL1104	KL1712	KL2124	KL2631
KL1114	KL1722	KL2134	KL2702
KL1124			
Analogue Inputs		**Analogue Outputs**	
KL3002	KL3052	KL4002	KL4022
KL3012	KL3062	KL4012	KL4032
KL3022	KL3064		
KL3042			