BECKHOFF New Automation Technology

Manual | EN

TX1200

TwinCAT 2 | PLC Library: COMlib3964RBC

PLC Libraries

Table of contents

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Version: 1.0

1   Foreword

1.1   Notes on the documentation

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with applicable national standards.
It is essential that the documentation and the following notes and explanations are followed when installing and commissioning the components.
It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.
We reserve the right to revise and change the documentation at any time and without prior announcement.
No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

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The EtherCAT Technology is covered, including but not limited to the following patent applications and patents:
EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702
with corresponding applications or registrations in various other countries.

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1.2 Safety instructions

Safety regulations

Please note the following safety instructions and explanations!
Product-specific safety instructions can be found on following pages or in the areas mounting, wiring, commissioning etc.

Exclusion of liability

All the components are supplied in particular hardware and software configurations appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

Personnel qualification

This description is only intended for trained specialists in control, automation and drive engineering who are familiar with the applicable national standards.

Description of symbols

In this documentation the following symbols are used with an accompanying safety instruction or note. The safety instructions must be read carefully and followed without fail!

⚠ DANGER
Serious risk of injury!
Failure to follow the safety instructions associated with this symbol directly endangers the life and health of persons.

⚠ WARNING
Risk of injury!
Failure to follow the safety instructions associated with this symbol endangers the life and health of persons.

⚠ CAUTION
Personal injuries!
Failure to follow the safety instructions associated with this symbol can lead to injuries to persons.

NOTE
Damage to the environment or devices
Failure to follow the instructions associated with this symbol can lead to damage to the environment or equipment.

Tip or pointer

This symbol indicates information that contributes to better understanding.

1.3   Notes on information security

The products of Beckhoff Automation GmbH & Co. KG (Beckhoff), insofar as they can be accessed online, are equipped with security functions that support the secure operation of plants, systems, machines and networks. Despite the security functions, the creation, implementation and constant updating of a holistic security concept for the operation are necessary to protect the respective plant, system, machine and networks against cyber threats. The products sold by Beckhoff are only part of the overall security concept. The customer is responsible for preventing unauthorized access by third parties to its equipment, systems, machines and networks. The latter should be connected to the corporate network or the Internet only if appropriate protective measures have been set up.

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To stay informed about information security for Beckhoff products, subscribe to the RSS feed at https://www.beckhoff.com/secinfo.

2 Overview

The TwinCAT PLC library, COMlibBC, offers function blocks and data structures for serial data communication with the Beckhoff BCxxxx bus controllers. COMlibBC supports the Beckhoff KL6xxx serial bus terminals.

In addition to the basic functions of sending and receiving transparent data, COMlib3964RBC supports the 3964R protocol. Both libraries are included in the 3964R package.

This documentation is to be seen as a supplement to the documentation COMlibBC.

3   Installation

Installation is performed by copying the following libraries into the TwinCAT directory TwinCAT\PLC\LIB.

- COMlibBC.LB6
- COMlibBC5B.LB6
- COMlib3964RBC.LIB

The associated test program should be copied to any project directory of your choice, e.g. to TwinCAT\PLC.

- https://infosys.beckhoff.com/content/1033/tcplclib3964rbc/Resources/zip/12263728779.zip

4 Functional description

4.1 P3694bufferBC

Data buffers of type P3964bufferBC are used in association with the P3964RBC function block. These buffers are written and read by the user.

```
TYPE P3964bufferBC
STRUCT
    D : ARRAY [0..16#03FF] OF BYTE;
END_STRUCT
END_TYPE
```

4.2 P3964RBC
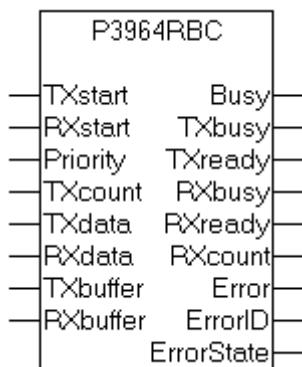

```
VAR_INPUT
    TXstart : BOOL;
    RXstart : BOOL;
    Priority: BOOL;
    TXcount : INT;
END_VAR
VAR_OUTPUT
    Busy     : BOOL;
    TXbusy   : BOOL;
    TXready  : BOOL;
    RXbusy   : BOOL;
    RXready  : BOOL;
    RXcount  : INT;
    Error    : BOOL;
    ErrorID  : INT;
    ErrorState: STRING(80);
END_VAR
VAR_IN_OUT
    TXbuffer: COMbuffer;
    RXbuffer: COMbuffer;
    TXdata  : P3964bufferBC;
    RXdata  : P3964bufferBC;
END_VAR
```

P3964bufferBC [▶ 10]

TXstart: start signal, edge triggered

RXstart: start signal, edge triggered

Priority: 3964 priority

TXcount: number of data bytes in TxData

Busy: function block active

TXbusy: sending status

TXready: sending finished

RXbusy: receiving status

RXready: receiving finished

RXcount: number of data bytes in RxData

Error: error

ErrorID: error number

ErrorState: internal error state

TXbuffer: intermediate buffer for hardware

RXbuffer: intermediate buffer for hardware

TXdata: application data (to be sent)

RXdata: application data (received)

Connection to Hardware

The P3964RBC function block handles the 3964R protocol. The background communication, which is handled by a separate function block (KL6ControlBC, KL6Control5B) decides on the hardware interface used. The associated data buffers, Txbuffer and Rxbuffer, are passed to the P3964RBC function block.

Sending

Send data are entered into the Txdata send data buffer by the PLC. The number of data bytes entered is passed on in Txcount, and then Txstart is set to TRUE. Txstart is edge-triggered, so that before a new attempt to send is made, the function block must be called with Txstart=FALSE. While sending, Txbusy=TRUE. Once the data has been successfully transferred, Txready changes to TRUE.

Receiving

RxStart is set to TRUE to receive data. After a complete data set has been received, the Rxready output goes TRUE and Rxcount data bytes are ready in the receive data buffer Rxdata. Rxstart is also edge-triggered. While receiving, Rxbusy=TRUE.

Interrupt reception

The P3964RBC function block can be used in either send or receive mode. It is worthwhile switching the function block to receive when transmission is not taking place. As long as the function block is in receive mode, but no start character has been received from the other device, a rising edge at Txstart can interrupt the reception and initiate the sending of data. After the transfer the function block goes into its initial state (Busy=FALSE), and is only switched over to receive by a new edge at Rxstart.

Priority

In a 3964R data connection, either end may send at any time. If both ends attempt to send at the same time, there is a collision. In that case, the end with the lower priority goes into receive mode, while the end with the higher priority sends again. For this reason, when priority is low the RxReady output can be TRUE, even though data are to be sent. The data in RxData may then require evaluation. The setting of the priority at the two ends is to be agreed.

Error

In the event of an error the function block goes into its initial state (Busy=FALSE), and the Error output goes TRUE. The ErrorId returns the error code [▶ 12]. ErrorState provides information about the state in which the error occurred when the internal protocol structure is known.

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4.3   Error Codes

No.	Error constant	Description
4	P3964ERR_ZVZ	The character delay time was exceeded. ZVZ = 220 ms. The character delay time is the maximum time interval between the transmission of two succeeding characters.
5	P3964ERR_QVZ	The acknowledgement delay time was exceeded. The other device sent an acknowledgement character (DLE = 10H) twice as the telegram was being handled. QVZ = 2 s. The first acknowledgement was expected at the start of the transmission. The output *ErrorState* is "Wait_DLE_TXstart" in case of an error. The cause might lie with a faulty physical connection or an incorrect interface parameter. The second acknowledgement is expected after the user data has been transmitted. If an error occurs, the *ErrorState* is "Wait_DLE_TXend". In this case the cause might, for instance, be data loss, data corruption or data bytes of a data word that have become swapped (see the *SwapWords* input).
6	P3964ERR_WVZ	The repeat delay time was exceeded. WVZ = 4 s. A telegram is repeated if an error occurs. If the telegram is not repeated by the other device, the 3964R function block reports this error.
7	P3964ERR_WRONGBCC	Checksum error during data reception. Each telegram is provided with a checksum. When the data is received, the calculated checksum is compared with the checksum that has been received.
9	P3964ERR_COMERRTX	Interface error when transmitting
10	P3964ERR_COMERRRX	Interface error when receiving
11	P3964ERR_NOTXDATA	Parameterization error. The number of bytes that are to be sent, *TxCount*, is zero.
20	P3964ERR_NAK	A telegram was refused by the other device with a negative acknowledgement (NAK).

No.	Error constant	Description
		This error can occur in the following transmission states (*ErrorState*), amongst others: *Wait_DLE_TXstart*: the local PLC begins a telegram with a start character. The other device refuses the telegram with NAK. *Wait_DLE_TXend*: the other device refuses the telegram with NAK after the user data has been transmitted. In this case the cause can, for example, be a checksum error at the other device.

5   Linking into a PLC Program

5.1   Link Libraries

Create a new PLC project with TwinCAT PLC Control in order to perform the library linking.

Go to Library Management and add the libraries ComLibBC.LB6 and ComLib3964RBC.LB6.
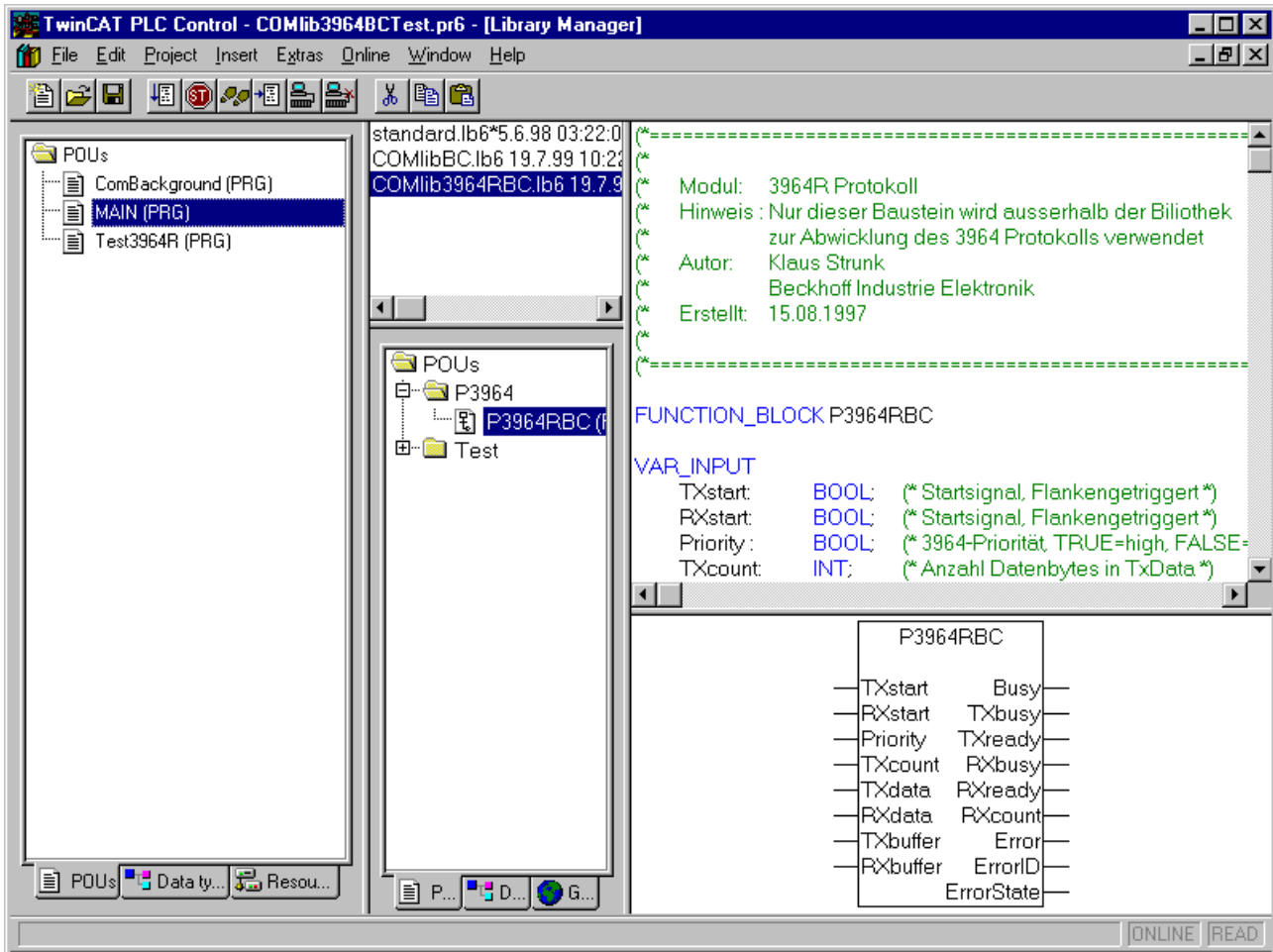
5.2   Global Variable

Four global data structures are needed to access a serial interface. Two provide the connection to the hardware in the send and receive directions. Two data buffers are also necessary for intermediate storage.
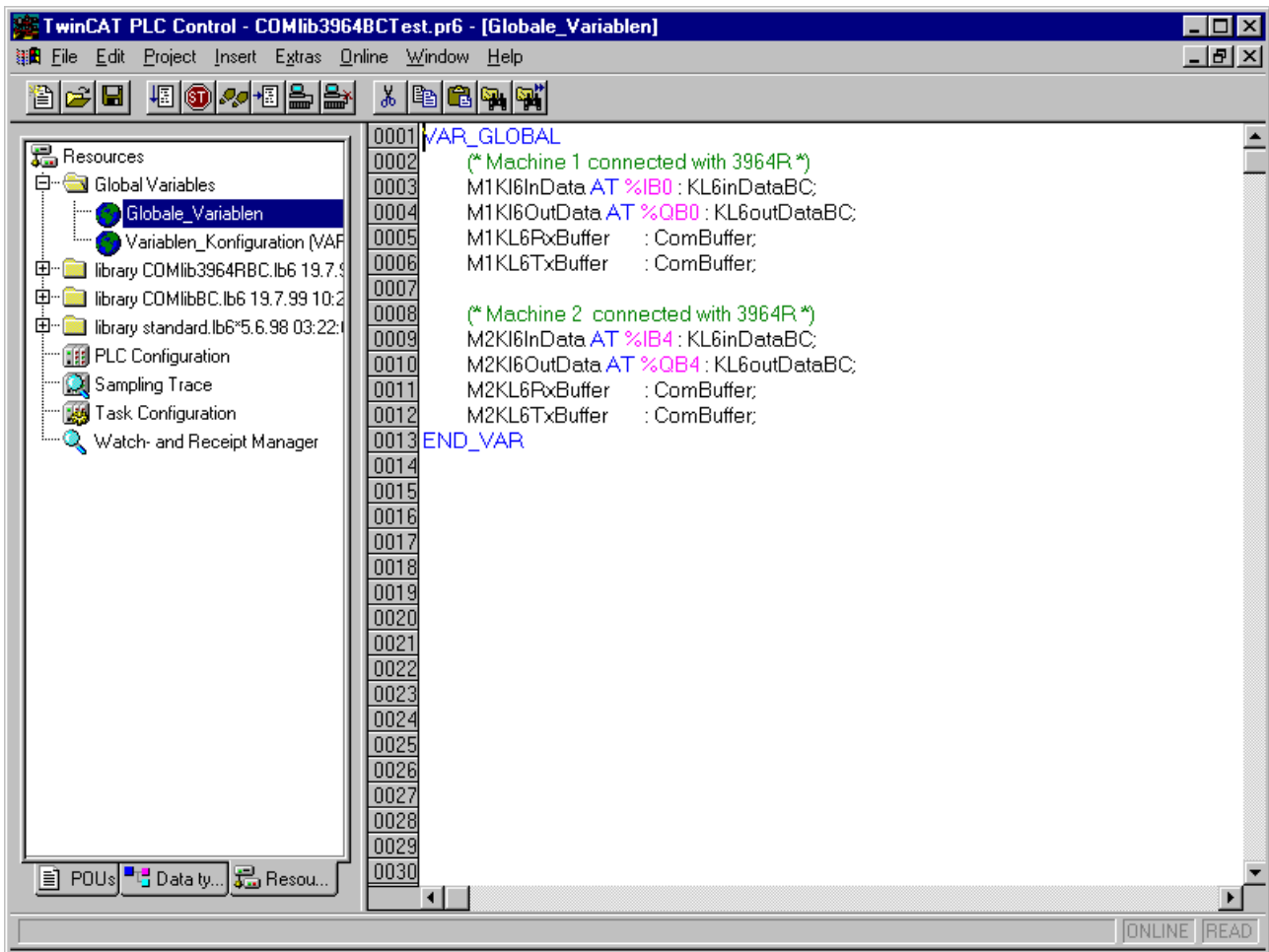
5.3 Background Communication

Communication between the serial hardware and the data buffer (of type ComBuffer) is handled along with the 3964R protocol in a separate function block.

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```
TwinCAT PLC Control - COMlib3964BCTest.pr6 - [ComBackground (PRG-ST)]        _ □ ×
  File  Edit  Project  Insert  Extras  Online  Window  Help                  _ ₧ ×

┌─────────────────────┐  ┌──────────────────────────────────────────────────┐
│ 📁 POUs              │  │0001│PROGRAM ComBackground                          │
│   ├─📄 ComBackground (PRG)│0002│VAR                                        │
│   ├─📄 MAIN (PRG)    │  │0003│    Machine1ComControl : KL6ControlBC;         │
│   └─📄 Test3964R (PRG)│ │0004│    Machine2ComControl : KL6ControlBC;         │
│                      │  │0005│END_VAR                                        │
│                      │  └──────────────────────────────────────────────────┘
│                      │  │0001│    Machine1ComControl(  COMin:=M1Kl6InData,   │
│                      │  │0002│                         COMout:=M1Kl6OutData, │
│                      │  │0003│                         TxBuffer:=M1KL6TxBuffer,│
│                      │  │0004│                         RxBuffer:=M1KL6RxBuffer );│
│                      │  │0005│                                               │
│                      │  │0006│    Machine2ComControl(  COMin:=M2Kl6InData,   │
│                      │  │0007│                         COMout:=M2Kl6OutData, │
│                      │  │0008│                         TxBuffer:=M2KL6TxBuffer,│
│                      │  │0009│                         RxBuffer:=M2KL6RxBuffer );│
│                      │  │0010│                                               │
│                      │  │0011│                                               │
│                      │  │0012│                                               │
│                      │  │0013│                                               │
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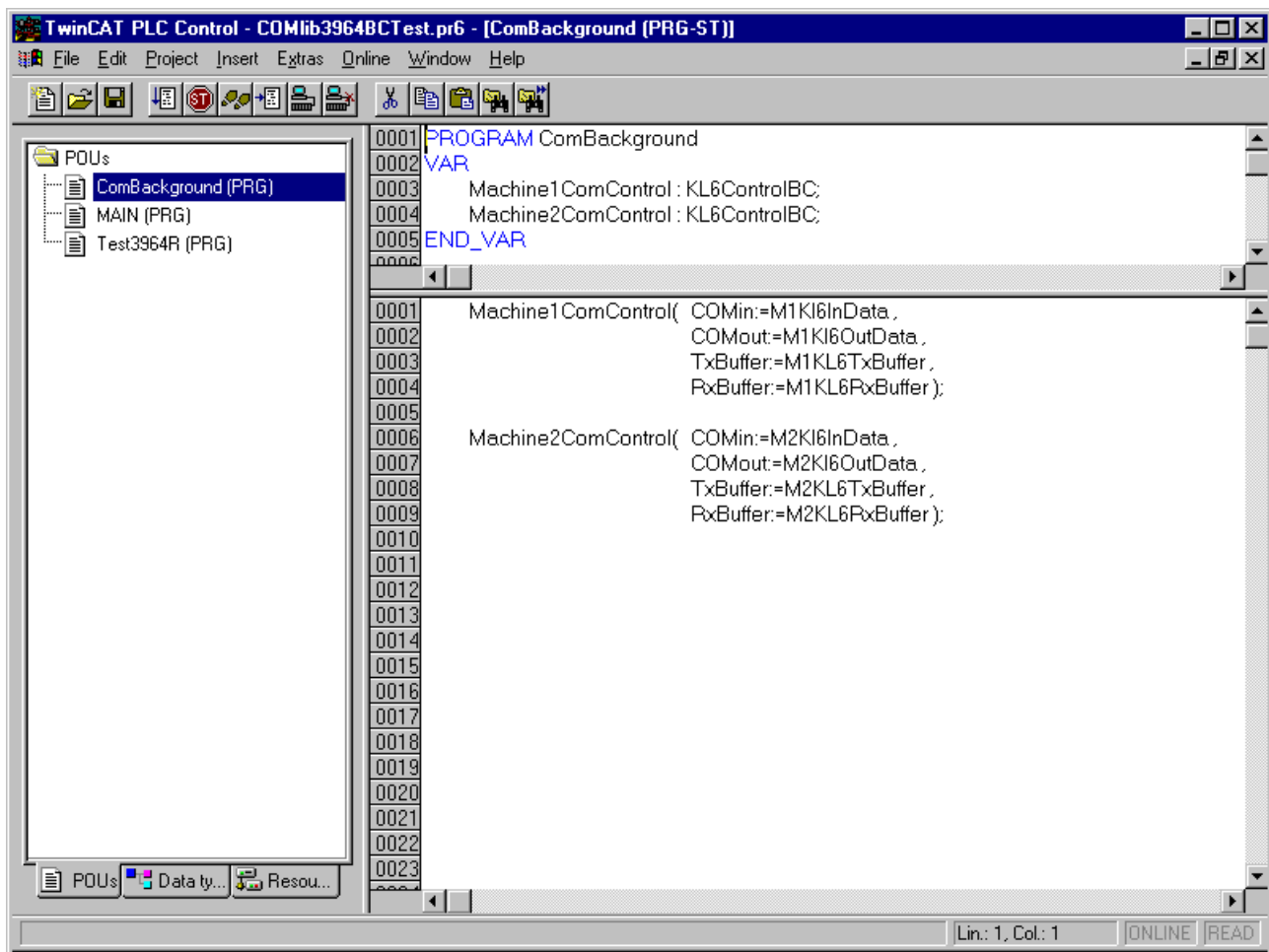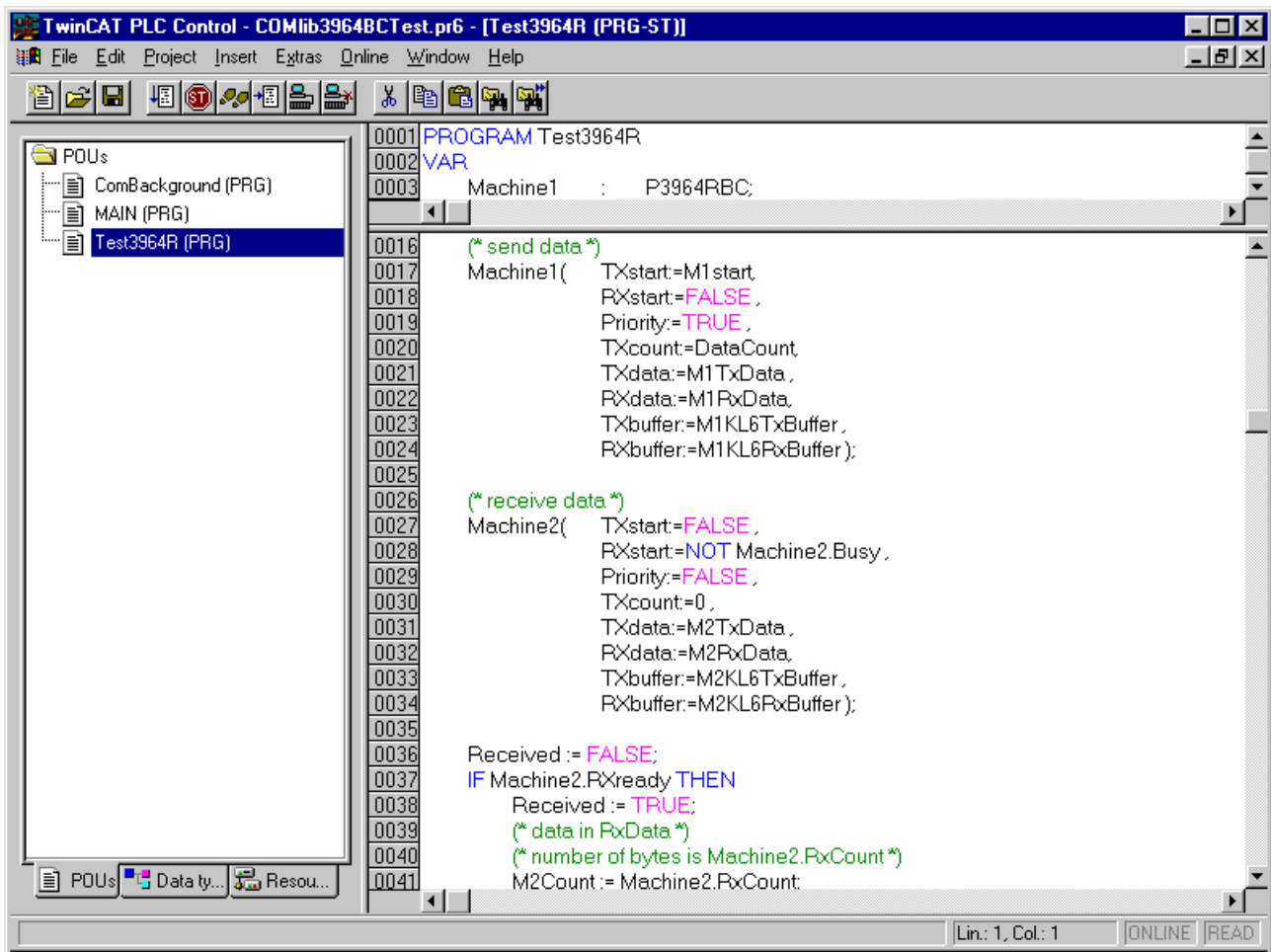
5.4   3964R Protocol

The sample program sends, for the purposes of demonstration, data to machine 1 every 10 seconds, and receives data constantly from machine 2.

5.5   Sample configuration

The sample program uses two serial bus terminals for communication. The RXD/TXD and RTS/CTS signals from the two terminals are cross-connected for the test. In that way data sent by one interface are received by the other.
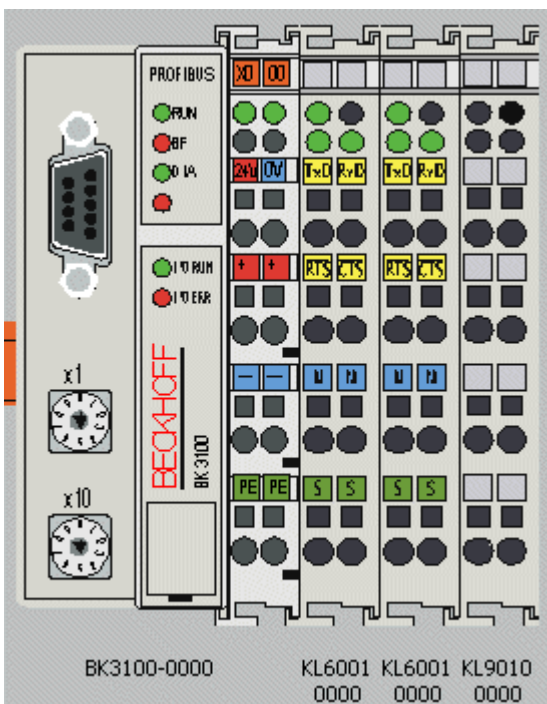
More Information:
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