4 Function blocks and parameters

Control functions

A large number of open-loop and closed-loop control functions, communication functions, as well as diagnostics and operator control functions are implemented in the software of the converters and inverters by means of function blocks. These function blocks can be parameterized and freely interconnected.

The interconnection method can be compared with electrical circuit engineering where various function units, e.g. integrated circuits or other components are interconnected by cables.

The difference is, however, that function blocks are interconnected not by cables, but via software.

4.1 Function blocks

Functions are implemented in function blocks. The function scope of the individual function blocks depends on its special task.

The function blocks are provided with inputs, outputs and parameters and are processed in time slots.

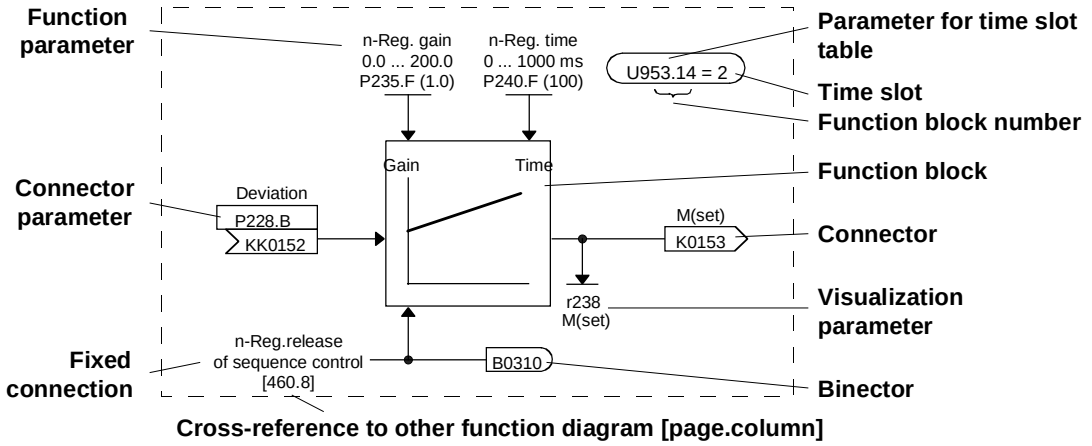


Fig. 4-1 A function block

Function block number

Each function block has a function block number (FB number) by which it can be clearly identified. With the FB number, you can define which time slot can be used for processing a large number of function blocks. For this purpose, each function block is allocated an indexed parameter which contains the relevant FB number in its parameter number and its parameter index.

Example:

U950.01 is the code of FB number 001
U953.50 is the code of FB number 250
U953.99 is the code of FB number 299
U954.74 is the code of FB number 374

The parameter for selecting the time slot as well as the corresponding factory setting are indicated in the function diagrams for each function block. This data takes the form of an ellipse in order to distinguish it optically from the other elements of a function block.

In addition to the time slot, the processing sequence can also be determined for most of the function blocks.

4.2 Connectors and binectors

Connectors and binectors are elements which are used to exchange signals between individual function blocks. They are each cyclically filled by function blocks with one signal value. Other function blocks can then call up these values, depending on parameterization.

Connectors

Connectors can be likened to storage locations which are used to archive "analog" signals. They are clearly designated. Each connector designation comprises the connector name, the connector number and an identification letter.

The identification letter depends on the numerical representation:

- K Connector with word length (16 bit)
- KK Connector with double-word length (32 bit, increased accuracy)

The connector number always has four digits.

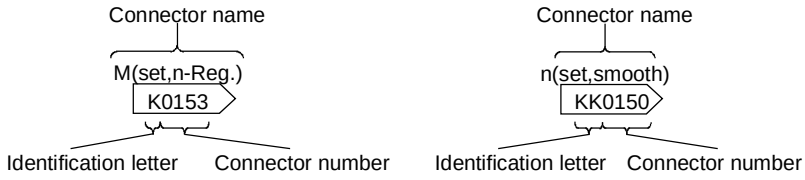


Fig. 4-2 Connectors with word lengths of 16 bit and 32 bit

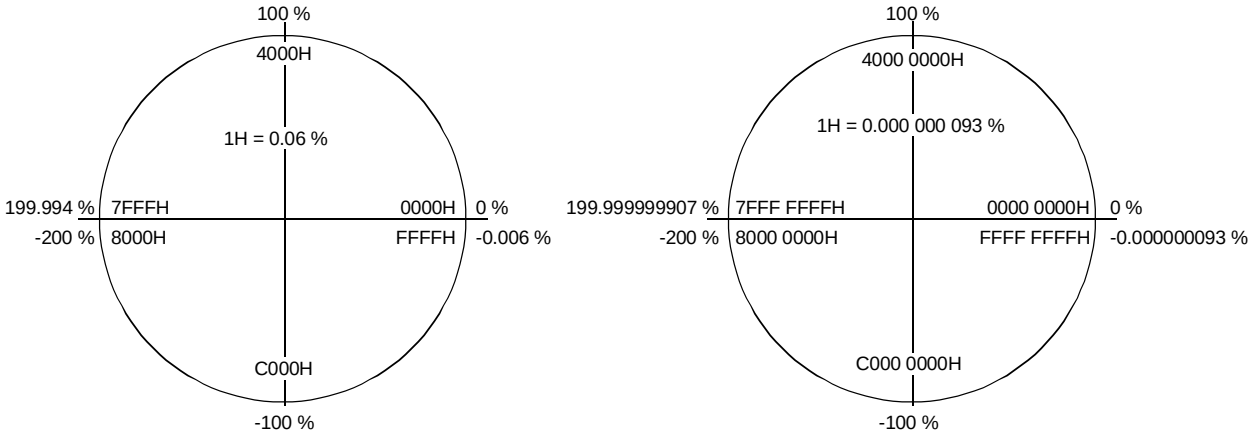
Value range of the connectors

The values stored in the connectors are normalized values, with a few exceptions (e.g. connectors for control words).

The value range of these connectors covers a percentage value range of:

- -200 % (8000H / 8000 0000H for double-word connectors) to
- +199,99 % (7FFFH / 7FFF FFFFH for double-word connectors).

100 % corresponds to the value 4000H (4000 0000H for double-word connectors).



Connector with word length (Kxxxx) Connector with double-word length (KKxxxx)

Fig. 4-3 Value range and assignment of the figure ranges for connectors

Binectors

Function blocks archive the **bi**nary (digital) output information in binary con**nectors**, the binectors. Binectors can therefore be likened to storage locations used for storing binary signals. They are clearly identified. Each binector designation comprises the binector name, the binector number and an identification letter. The identification letter is B.

The binector number always has four digits.

On account of their definition, binectors can only assume the two states "0" (logically no) and "1" (logically yes).

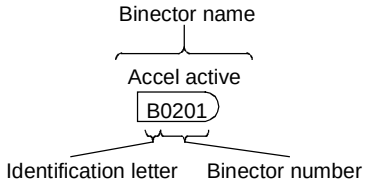


Fig. 4-4 Binectors

4.3 Parameters

Parameters are the intervention points for adapting function blocks to an application, for interconnecting function blocks via connectors and binectors and for visualizing internal signals.

The various parameters are differentiated according to their function as follows:

- Function parameters (can be read and written)
- BICO parameters (can be read and written)
- Visualization parameters (can only be read).

Each parameter is clearly designated. The parameter designation comprises the parameter name and the parameter number, and enables every parameter to be clearly identified. In addition to the parameter name and the parameter number, many parameters also have a parameter index. With the aid of this index, it is possible to store several values for one parameter under one parameter number.

The function diagrams indicate the factory setting for every BICO parameter and every function parameter. They further indicate the value ranges for the changeable function parameters.

Parameter numbers on the PMU

The parameter numbers shown on the parameterizing unit (PMU) which is directly mounted on the unit consist of a letter and a three-digit number.

The following applies for the letters:

- Upper-case letters (P, U, H and L) represent the BICO parameters and function parameters which can be changed
- Lower-case letters (r, n, d and c) represent the visualization parameters which cannot be changed.

The three-digit number covers the value range from 000 to 999; but not all values are used.

Parameter numbers on the OP1S

The OP1S operator control panel enables parameters to be selected directly by their parameter numbers. As the OP1S only has a numerical keypad, the letter of the parameter number must be replaced by a number. The following replace mode is applicable:

- "P"xxx and "r"xxx are replaced by "0"xxx
- "H"xxx and "d"xxx are replaced by "1"xxx
- "U"xxx and "n"xxx are replaced by "2"xxx
- "L"xxx and "c"xxx are replaced by "3"xxx

Examples:

Select r004 on OP1S: Input 0004
Select P050 on OP1S: Input 0050
Select U123 on OP1S: Input 2123
Select L411 on OP1S Input 3411

Function parameters

The response of a function block is determined by function parameters. Typical examples of function parameters are:

- Normalization of an input signal
- Acceleration or deceleration times in the ramp-function generator
- Proportional gain (Kp) and integral time (Tn) in the speed controller.

Function parameters can be indexed. The significance of the parameter values stored in the various indices depends on the definition of the respective parameter. A special group is formed by the function parameters which are part of the so-called function data sets.

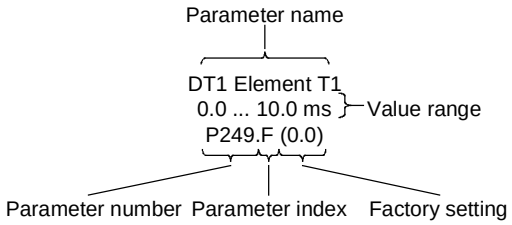


Fig. 4-5 Function parameters

Function data sets (Setpoint data sets)

Special function parameters are put together in function data sets. These parameters are marked in the function diagrams with the parameter index **.F**.

The parameters concerned are indexed four-fold, which means that one parameter value can be stored under each parameter index, i.e. a total of four parameter values can be stored.

The active function data set determines which value is currently being used. If function data set 1 is active, the parameter value stored in parameter index 1 is used. If function data set 2 is active, the parameter value stored in parameter index 2 is used, etc.

Example:

P462.1 = 0.50
P462.2 = 1.00
P462.3 = 3.00
P462.4 = 8.00

A total of 4 values are stored under parameter P462 (Accel Time). If function data set 1 is active, the acceleration time is 0.50 secs. If function data set 2 is active, the acceleration time is 1.00 secs. If function data set 3 is active, the acceleration time is 3.00 secs and if function data set 4 is active, the acceleration time is 8.00 secs.

The individual function data sets are selected by means of control word bits 16 and 17 in control word 2 (P576.B and P577.B). Changeover is possible at any time.

The active function data sets are displayed via the visualization parameter r013 (Active FuncDSet).

NOTE

Changeover of all the indexed parameters of the function data sets between parameter indices 1, 2, 3 and 4 is always effected jointly.

Using function parameter P364, it is possible to copy the parameter settings of one function data set (index 1, 2, 3 or 4) into another function data set.

Motor parameters

The motor parameters enable the converter to the be adapted to the connected motor and enable the open-loop and closed-loop control structure to be adapted. Typical examples for motor parameters are:

- Rated motor data from the rating plate
- Specification of the connected tachometer
- Current and output limits

Motor parameters are indexed 4-fold.

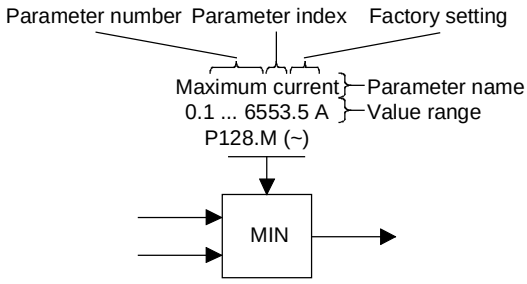


Fig. 4-6 Motor parameters

Motor data sets

Selected function parameters are put together in motor data sets. These parameters are marked in the function diagrams with the parameter index **.M**

The parameters concerned are indexed four-fold, which means that one parameter value can be stored under each parameter index of these parameters, i.e. a total of four parameters can be stored.

The active motor data block (MDS) determines which value is currently being used. If MDS1 is active, the parameter value stored in parameter index 1 is used, if MDS2 is active, the parameter value stored in parameter index 2 is used, etc

Example:

P100.1 = 4
P100.2 = 3
P100.3 = 1
P100.4 = 1

A total of 4 values are stored under parameter P100 (Control Mode). If motor data set 1 is active, the drive operates in speed control with a tachometer. If the motor data set 2 is active, the drive operates in frequency control without a tachometer. If motor data set 3 and 4 are active, the drive operates in v/f control.

Individual motor data sets are selected via control word bits 18 and 19 in control word 2 (P578.B and P579.B).

Changeover is only possible in the powered-down state.

NOTE

All indexed parameters of the motor data sets are always changed over jointly between parameter indices 1, 2, 3 and 4.

Using function parameter P362, it is possible to copy the parameter settings of one motor data set (index 1, 2, 3 or 4) into another motor data set.

BICO parameters

With BICO parameters, you can determine the sources of the input signals of a function block. This means that you can use BICO parameters to define the connectors and binectors from which a function block reads in its input signals. In this manner, you can "soft-wire" the function blocks stored in the units to meet your requirements. This is referred to as the BICO system.

For every BICO parameter, the type of input signals (connector or binector) which you can connect to the inputs is specified. BICO parameters have the following identification:

- B Binector parameter
  for connecting binectors
- K Connector parameter
  for connecting connectors with word length (16 bit)
- KK Connector parameter
  for conneting connectors with double-word length (32 bit)

Reciprocal "softwiring" of binectors and connectors is not permitted. However, you can always connect connector with word length and double-word length to the connector parameters.

BICO parameters are available in two forms; they can either be

- non-indexed, or
- double-indexed.

BICO data sets (Basic/reserve data sets)

Selected BICO parameters are put together in BICO data sets. These parameters are marked in the function diagrams with the parameter index **.B.**

The parameters concerned are double-indexed, which means that one parameter value can be stored under each parameter index of these parameters, i.e. a total of two parameter values can be stored.

The active BICO data set determines which value is currently being used. If BICO data set 1 is active, the parameter value stored in parameter index 1 is used. If BICO data set 2 is active, the parameter value stored in parameter index 2 is used.

Example:

P554.1 = 10
P554.2 = 2100

A total of 2 values are stored under parameter P554 (Src ON/OFF1). If BICO data set 1 is active, the ON command comes from digital input 1 of the basic unit. If BICO data set 2 is active, the ON command comes from bit 0 of the first data word received by serial interface 1.

Individual BICO data sets are selected by means of control word bit 30 in control word 2 (P590.

The active BICO data set is displayed via visualization parameter r012 (Active BICO DS).

NOTE

All indexed BICO parameters are always switched jointly between parameter index 1 and 2.

Using function parameter P363, it is possible to copy the parameter settings of one BICO data set (index 1 or 2) into another BICO data set.

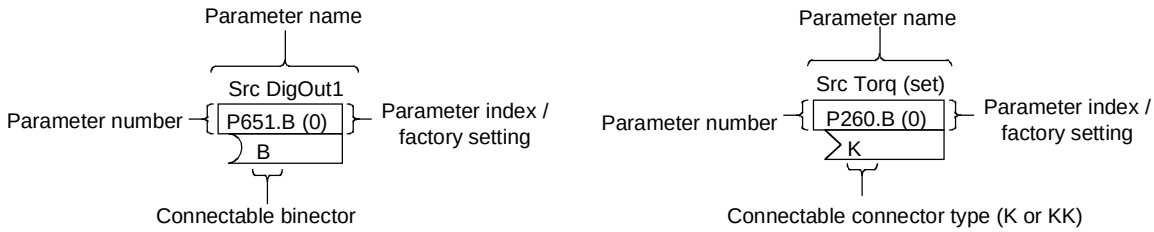


Fig. 4-7 Connectors with word lengths of 16 bit and 32 bit

Visualization parameters

Visualization parameters are used for visualizing internal quantities (e.g. applicable output current). These parameters are only displayed and cannot be changed by you.

To distinguish them from the other parameters, they are designated with a lower-case letter (r, n, d and c) in the parameter number.

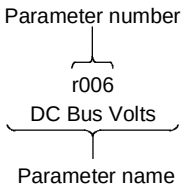


Fig. 4-8 Visualization parameters

4.4 Connecting up function blocks (BICO system)

BICO system is the term used to describe the method of creating connections between function blocks. This is performed with the aid of **bi**nectors and **co**nnectors. The name **BICO** system is derived from these two terms.

A connection between two function blocks consists of a connector or binector on the one side, and a BICO parameter on the other side. The connection is always made from the point of view of the input of a function block. You must always assign an output to an input. Assigment is made by entering in a BICO parameter the number of the connector or the binector from which the required input signals are read in. You are allowed to enter the same connector and binector numbers several times in different BICO parameters and thus use output signals of one function block as input signals for several other function blocks.

Example:
In the following figure, connector K0152 is connected to connector parameter P228. For this purpose, you must assign the number of connector K0152 as the value to the connector parameter P228 , i.e. in this case 152.

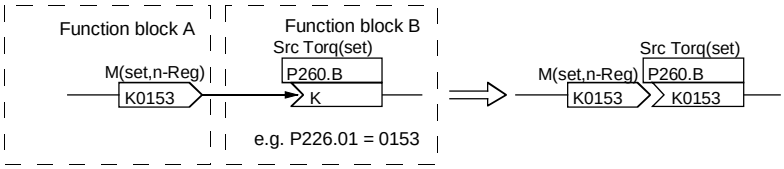


Fig. 4-9 Connecting two function blocks

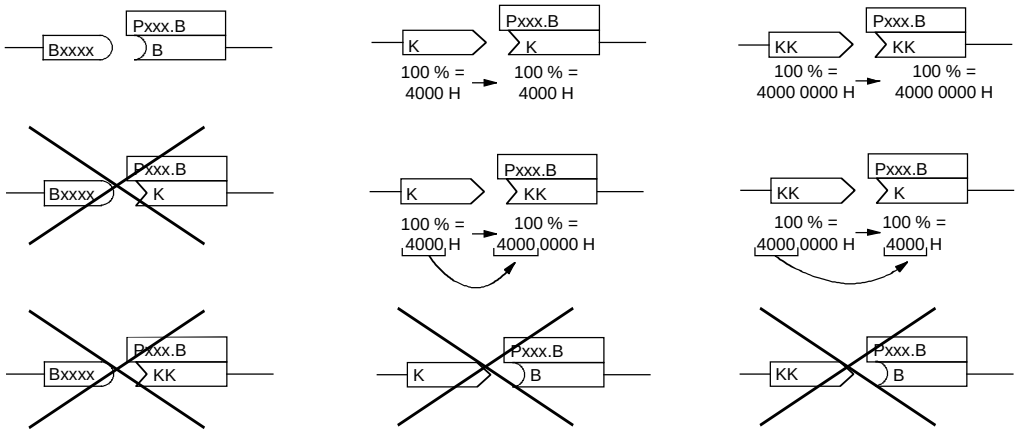


Fig. 4-10 Possible and impossible BICO connections

Interconnecting different connector types

Depending on their characteristics, connectors either have a length of a word (16 bit) or a double-word (32 bit). Accordingly, function blocks have BICO parameters which are suitable for connecting the respective connector type. It is, however, possible in principle to mix the types among the connectors. The word length is then automatically adjusted according to the following mode:

Interconnection of a word connector to	a word connector parameter	Value stays the same
	a double-word connector parameter	Value is taken over in high-word, low-word is filled up with 0000H
Interconnection of a double-word connector to	a word connector parameter	Value is taken over from high-word, low-word deleted
	a double-word connector parameter	Value stays the same

NOTICE

When a double-word connector is interconnected to a word connector parameter, the signal resolution will drop from 32 bit to 16 bit. As the low-word is cut off, the information of the lower-order 16 bit of the double-word connectors is then lost.