Contents Page

Basic logic **5–3**
Application 5–3
Theory of operation 5–3
Design 5–3
Display functions **5–7**
Application 5–7
Design 5–8
INFO_TXT (C6040) 5–8
INFO_LED (C6041) 5–8
PARAM (C6042) 5–8
Appendix 5–9
Function blocks 5–9
Signal lists 5–10
Settings tables 5–11

1 Application

Different control and monitoring functions within the REC580 are quite independent as far as their configuration in the terminal is concerned. The user can also configure different functions in the terminals to suit special requirements for different applications. For this purpose logic circuits are needed to configure the terminals to meet user needs and also to build in some special logic circuits, which use different logic gates and timers.

2 Theory of operation

The programming language used is based upon the IEC 1131-3 standard basic function blocks.

The IEC 1131-3 standard includes several graphical and textual programming languages. It is a widely used programming language that is used to create complicated networks with functions or function blocks. Networks are created with lines that connect or duplicate information.

Within IEC 1131-3 are several *function blocks* and *functions* available. Function blocks have multiple input and output parameters. They do have an internal memory. The value that a function block returns depends on the value of its internal memory.

Functions have multiple input parameters and exactly one output parameter. They do not have any internal memory. Consequently, calling a function with the same values always the same return values result. The return values can be either single or multi-element variables such as arrays or structures.

3 Design

All function blocks and functions are extensively described in the help function of the engineering tool with parameters and examples of configuration and settings. The following tables contains the complete available set of basic logic functions and function blocks.

Table 1: Available function blocks

Function	Usage
SR	Set dominant
RS	Reset dominant
R_TRIG	Rising edge detector
F_TRIG	Falling edge detector
CTU	Up-counter
CTD	Down-counter
CTUD	Up-down-counter
TON	On-delay timer
TOF	Off-delay timer
TP	Pulse

Table 2: Available functions

Function	Usage
*_TO_**	Type conversion from data type * into data type **
ABS	Absolute value
ACOS	Principal arc cosine
ADD	Add function
ADD_T_T	Add function
AND	Boolean AND
ASIN	Principal arc sine
ATAN	Principal arc tangent
CONCAT	Extensible concatentation
COS	Cosine in radians
DELETE	Delete section
DIV	Divisor
DIV_T_AN	Divisor
EQ	Equal to ($a = b$) comparision
EXP	Natural exponential
EXPT	Exponentiation
FIND	Find character position
GE	Greater than or equal ($a \geq b$) comparision
GT	Greater than ($a > b$) comparision
INSERT	Insert string
LE	Less than or equal ($a \leq b$) comparision
LEFT	Leftmost character
LEN	String length
LIMIT	Limitation
LN	Natural logarithm
LOG	Logarithm base 10
LT	Less than ($a < b$) comparison
MAX	Maximum
MID	Middle of string
MIN	Minimum
MOD	Modulo division
MOVE	Allocation
MUL	Multiplication
MUL_T_AN	Multiplication
NE	Not equal to ($a \neq b$) comparison
NEG	Double complement
NOT	Complement
OR	Boolean OR
REPLACE	Replace section

Table 2: Available functions

Function	Usage
RIGHT	Rightmost character
ROL	Rotate left
ROR	Rotate right
SEL	Binary selection
SHL	Shift left
SHR	Shift right
SIN	Sine of input in radians
SQRT	Square root
SUB	Subtractor
SUB_T_T	Subtractor
TAN	Tangent in radians
TRUNC	Truncation
XOR	Boolean exclusive OR

All available basic functions and basic function blocks are described in detail in the CAP 580 on-line manual.

1 Application

The display functions are used as an interface between the terminal and the LCP display. With the function can clear text be related to the LED's and diagnostic information. Parameters can also be displayed and edited.

2 Design

The function blocks are implemented in IEC 1131 programming language supported by Mwt.

2.1 INFO_TXT (C6040)

The function block INFO_TXT is used as interface between the control sequence and the LCP display. The priority of the 20 signals is fixed in the base software of the LCP and not in the ASW. The corresponding texts on the single line (see database) for example can be:

Table 1: Example for texts

ID	Text
20	Object cannot be selected: authority allocation is not local
19	Select object and confirm (, bar graph ((, alarm list ?
18	Object is selected, for execute press O, cancel selection with
17	Object is selected, for execute press 1, cancel selection with
16	Object is blocked: PISA is not ready, see alarm list
15	Object is blocked: hand crank is plugged
14	Object is blocked: motor is not ready, see alarm list
13	Object is blocked: object has no position -> interlocking override
12	Object is blocked: CB switch energy to low
11	Object is blocked: SF6 gas pressure to low
10	Object is blocked: Protection blocked
9	Object cannot be selected: Double operate interlocking (DOPI)
8	Object is interlocked: CB has to be opened first
7	Object is interlocked: disconnector has to be opened first
6	Object is interlocked: earthing switch has to be opened first
5	Object is interlocked: position of other objects not available
4	Selection is cancelled
3	Synchronisation is running
2	Operation was successfully
1	Operation was not successfully: see alarm list

2.2 INFO_LED (C6041)

The function block INFO_LED is used as interface between the alarm sequence and the LED on the LCP display. The outputs can be forced to 1 for a lamp test or to 0 to switch of the LED’s.

2.3 PARAM (C6042)

The function block PARAM is used as interface between the RETAIN-variables and the parameter pages on the LCP display.

3 Appendix

3.1 Function blocks

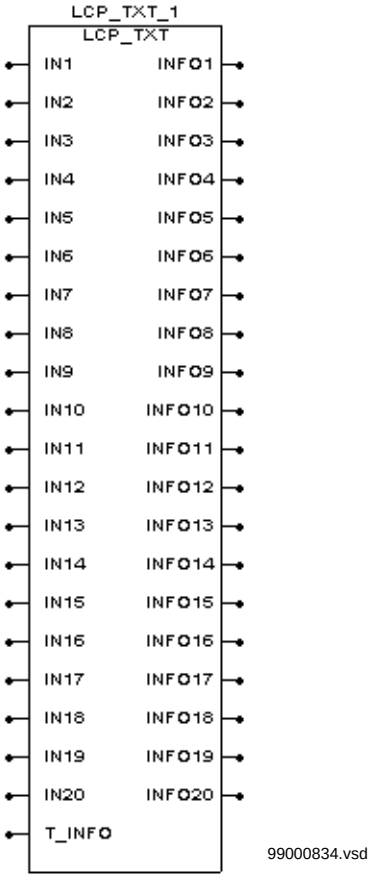

Figure 1: Function block INFO_TXT

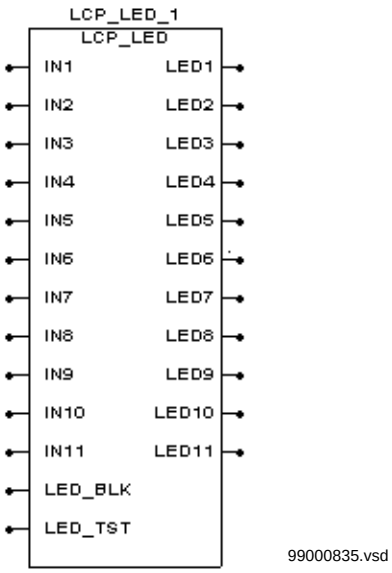

Figure 2: Function block INFO_LED

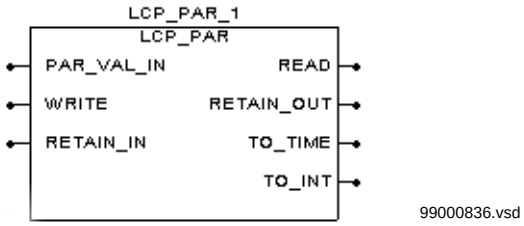

Figure 3: Function block PARAM

3.2 Signal lists

Table 2: Signal list for function block INFO_TXT

Signal	Type	In/Out	Description
IN1-IN20	BOOL	In	The inputs set the corresponding outputs
T_INFO	TIME	In	See settings table
INFO1-INFO16	BOOL	Out	Outputs are set when the corresponding inputs are set and resets when the time set (T_INFO) has elapsed. These outputs are used as alarms.
INFO17-INFO20	BOOL	Out	Outputs are set when the corresponding inputs are set. This outputs are used as guides to control a switchgear

Table 3: Signal list for function block INFO_LED

Signal	Type	In/Out	Description
IN1-IN11	BOOL	In	The inputs set the corresponding outputs.
LED_BLK	BOOL	In	If this input is set, all outputs will be set to 0.
LED_TST	BOOL	In	If this input is set, all outputs will be set to 1.
LED1-LED11	BOOL	Out	Outputs are set when the corresponding inputs are set or the input LED_TST is set. The outputs are reset when the input LED_BLK is set.

Table 4: Signal list for function block PARAM

Signal	Type	In/Out	Description
PAR_VAL_IN	BOOL	In	Input for writing the value from the input WRITE to all outputs. (Signal from the LCP)
WRITE	DINT	In	The value on this input will be written to the outputs if the input PAR_VAL_IN is set. (Signal from the LCP)
RETAIN_IN	DINT	In	The value on this input will be write to the outputs if the input PAR_VAL_IN is not set. The input signal is of the type RETAIN an has the same name as the output RETAIN_OUT is connected to.
READ	DINT	Out	The value on this output represent the value of the selected input. (Signal to the LCP)
RETAIN_OUT	DINT	Out	The values on this output will be written to the RETAIN-signal which is also connected to the input RETAIN_IN.
TO_TIME	TIME	Out	The value on this output represent the converted value of the selected input to time.
TO_INT	INT	Out	The value on this output represent the converted value of the selected input to integer.

3.3 Settings tables

Table 5: Setting table for function block INFO_TXT

Parameter	Type/ [unit]	Usable range	Default	Description
TIME_INFO	TIME [s]	1-60	5	Input for setting the pulse duration of the outputs INFO1-INFO16.