SIEMENS

SIMATIC S5

GRAPH5-EDDI
Sequential Control System with Continuous Error Diagnosis

Description

C79000-G8576-C697-03

Contents

Introduction to Using GRAPH5-EDDI

1

1.1 Introduction to the Manual

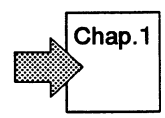
Whom and how does the manual help?

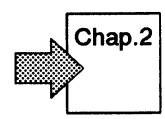
The manual "GRAPH5-EDDI" contains the information required for performing the following tasks for those inexperienced in the programming of sequential control systems as well as for professionals:

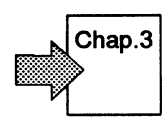
- Selection of existing program files or creation of new ones;
- Project planning/generation of sequential programs with sequence and interlock monitoring for step sequencers;
- Programming documentation on the PG.

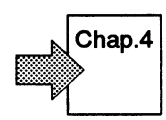
Where to find what?

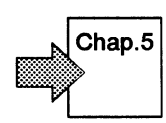
The following subjects are dealt with individually in the manual:

- Introduction to the use of GRAPH5-EDDI. 

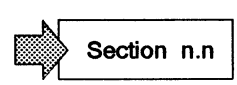
- Features and method of operation of a sequential control system planned with GRAPH5-EDDI. 

- Introduction to project processing on the PG/PC, creation of a GRAPH5-EDDI program. 

- Example: Creation of a GRAPH5-EDDI program for an embossing machine. 

- Technical data (quantified project data, parameters etc.) for GRAPH5-EDDI blocks, modes and special actuators. 

Information representation in the manual

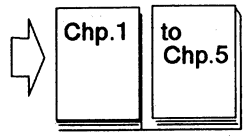
- In all cases you will find the information on a subject or a subtask on a double page (or two double pages) in a completed form, frequently also supplemented with graphics.
- First take a glance at the title and keywords on the subject in hand on the left margin in order to get quick information on your queries.
- A subject block answers questions on the GRAPH5-EDDI functions and gives information about the necessary or recommended manipulations when using GRAPH5-EDDI.
- References to further information on a subject in other sections are marked as shown on the right: 

- Handling instructions are marked by a black triangle: ▶
- Handling sequences are numbered: 1, 2, 3 etc.
- A list of the abbreviations used is given in Appendix A.

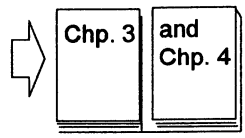
  You can gain direct access to each subject block contained in the manual by consulting the index (Appendix B).

What must you read?

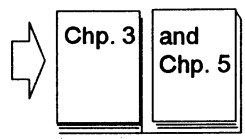
You are a novice when it comes to using procedures and tools for creating sequential control systems.



You are conversant with the structure and method of functioning of step blocks and sequencers.



You are acquainted with the previous version of GRAPH5-EDDI and want to use the new version.



Basic knowledge of the SIMATIC programming in STEP 5 and GRAPH 5 is assumed. Without this knowledge, it would very likely be difficult to and perform a task quickly and effortlessly with GRAPH5-EDDI.

Differences vis-à-vis previous versions of GRAPH5-EDDI

The following additions/modifications have been made vis-à-vis version 2.0 of GRAPH5-EDDI:

1. Project planning form on PG/PC (can also be printed out) with software generation.
2. Conversion to GRAPH5-Editor V 6.x (stage 6).
   In this manner a faster machine cycle is achieved since one PLC cycle is saved for each step enabled.
3. Presentation of the user DB.
4. Function expansions on the FB78/SB8:

- The modes can be selected externally (parameters on the FB78) or internally (data word in user DB).
- The modes have been supplemented with the functions:
  - Step selection,
  - Guided manual operation,
  - Single step no actions,
  - Step search.
- The functions in the modes have been supplemented with:
  - Bounce time for interlocks,
  - Two flashing contacts integrated,
  - Free selection of the block number for SB-sequencer to which the numbers for PB-MANUAL, PB-OUTPUT and SB-FILTER are assigned.

5. An example (embossing machine –> Chap. 4) for quick familiarization with the programming has been supplied on a diskette.

Other manuals on the subject

SIMATIC S5: "GRAPH 5/II"
Part of software package: 6ES5886-1FA12
STEP 5 Documentation package: 6ES5998-0SY21

1.2 Introduction to the Software Package GRAPH5-EDDI

What is GRAPH5-EDDI?

GRAPH5-EDDI (G5E) is a SIMATIC software package which in conjunction with GRAPH5/II permits simple and reliable project planning and programming of sequential control systems with linear sequencers. When using this tool, programming is in most cases restricted to the step-related entry of the signal and flag operands (absolute or symbolic) in a specified form on the PG/PC. GRAPH5-EDDI stands for GRAPH 5 Error Dynamic Diagnostic Indication.
In short:
GRAPH5-EDDI is a formalized project planning guideline for sequencers with an easy-to-manage editor operator interface and program generator.

How and for what purpose do you use GRAPH5-EDDI?

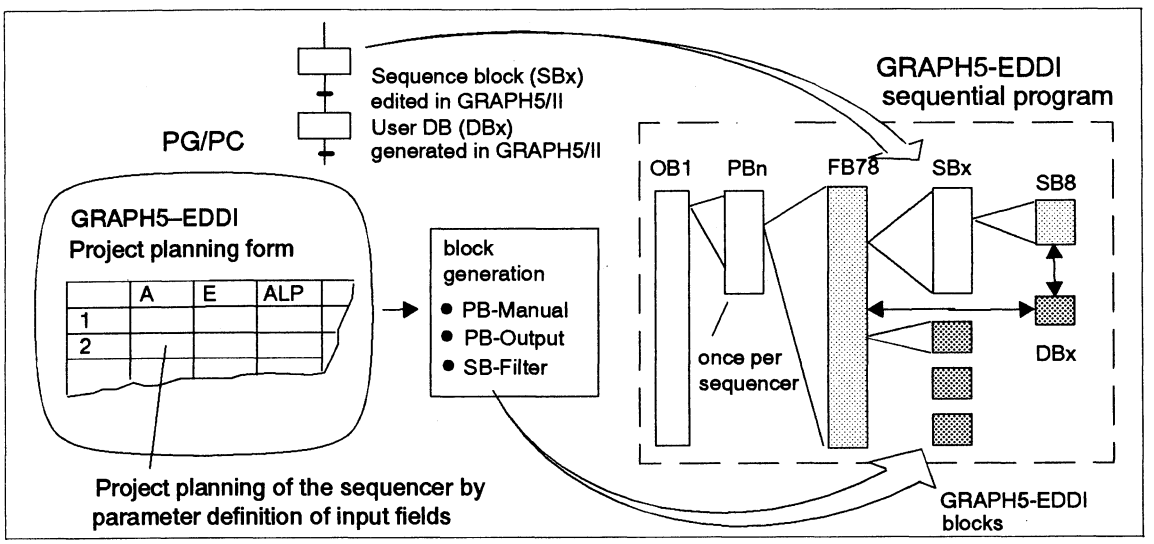
In its present Version 3, the software package GRAPH5-EDDI only runs in conjunction with GRAPH5/II (version $\geq$ 6.0) on any "fully" AT-compatible PG/PC (with EGA/VGA card). The software versions must support 16 gray shades. In the following, PG and PC are equivalent.
Precondition for upgrading of GRAPH5 to GRAPH5/II:

- ST-package: MS-DOS $\geq$ 5.0; STEP 5 $\geq$ 6.0; GRAPH5/II $\geq$ 6.0
- MT-package: FLEXOS $\geq$ 2.3; STEP 5 $\geq$ 6.0; GRAPH5/II $\geq$ 6.0.

Programs created with GRAPH5-EDDI are used primarily for controlling concatenated movement procedures as occurring in the manufacturing industry, e.g. in the case of piece production. In particular in this sphere, a vast amount of specific plant information is available to the operating staff so that interventions are possible at all times and any sources of faults can be quickly detected and eliminated.

How do you create a GRAPH5-EDDI program?

For each linear step sequencer you enter into a project planning form on the PG/PC the series of processing steps as a series of lines of the system parameters and structure the sequencer in an associated SB (in GRAPH 5/II).



As illustrated in the diagram, programming a sequencer with GRAPH5-EDDI calls for only a few and simple editing tasks:

1. Entry of the operands into the project planning form;
2. Generating the G5E blocks;
3. Editing the sequencer block SBx in GRAPH5 5/II;
4. Generating the user data block DBx in GRAPH5 5/II (DBGEN);
5. Loading the SBx/DBx and the G5E blocks in the PLC;
6. Programming the parameters of FB78: once in a PB for each sequencer
7. Integration of the sequencers in OB1 and if applicable, in the start-up OBs.

The standard blocks FB78 and SB8 as well as OB1 need only be present once in the CPU.

What can you do with GRAPH5-EDDI?

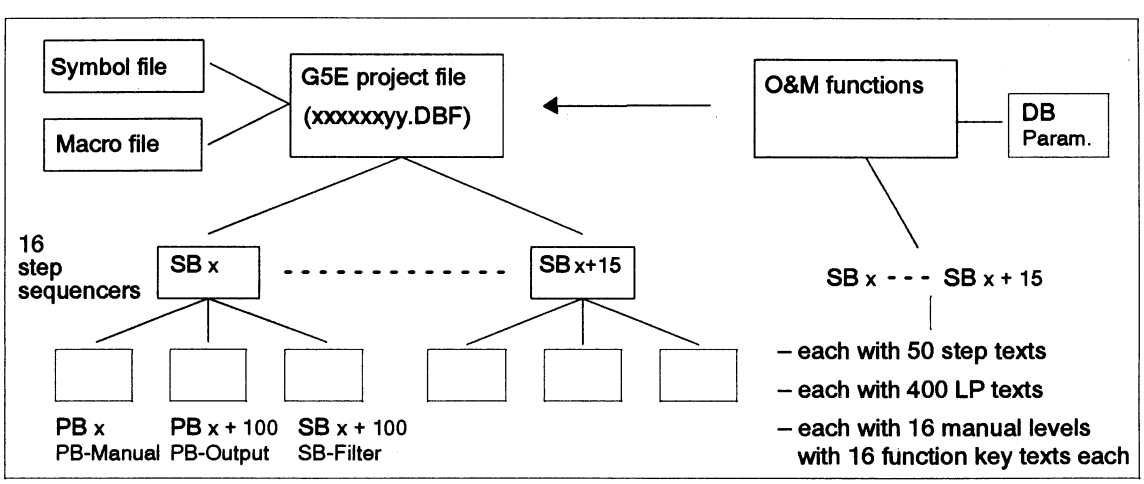
Normally, programs for sequential control systems are entered, in compliance with IEC 1131-3, as a flowchart stored in sequence blocks. Here, the processing steps and step-enabling conditions must be programmed in LAD, CSF or STL.

For the more frequent case of linear sequencers, GRAPH5-EDDI reduces the programming required to merely filling out a form on the PG.
This "project planning" is later converted automatically into a runnable sequential program.

- G5E programs can be used on different HW in different systems, offering the advantage of the same operating facilities for the modes and their monitoring functions.
- The stepwise processing of the sequencers together with the special features of the G5E blocks enable a high-performance (permanent) diagnosis of the process sequence or of the program in the event of faults.
- Process elements, having no direct relation with the currently processed step, can also be monitored.
- Program documentation can be compiled constantly by one PG.
- Editor functions are available for providing information on the system.

Extent of the project planning software G5E

An S5 sequential program generated with GRAPH5-EDDI can contain up to 16 step sequencer blocks, each with three user blocks acc. to the following overview:



1.3 Operating Structure and Functions of GRAPH5-EDDI (Version 3)

Division of the GRAPH5-EDDI software

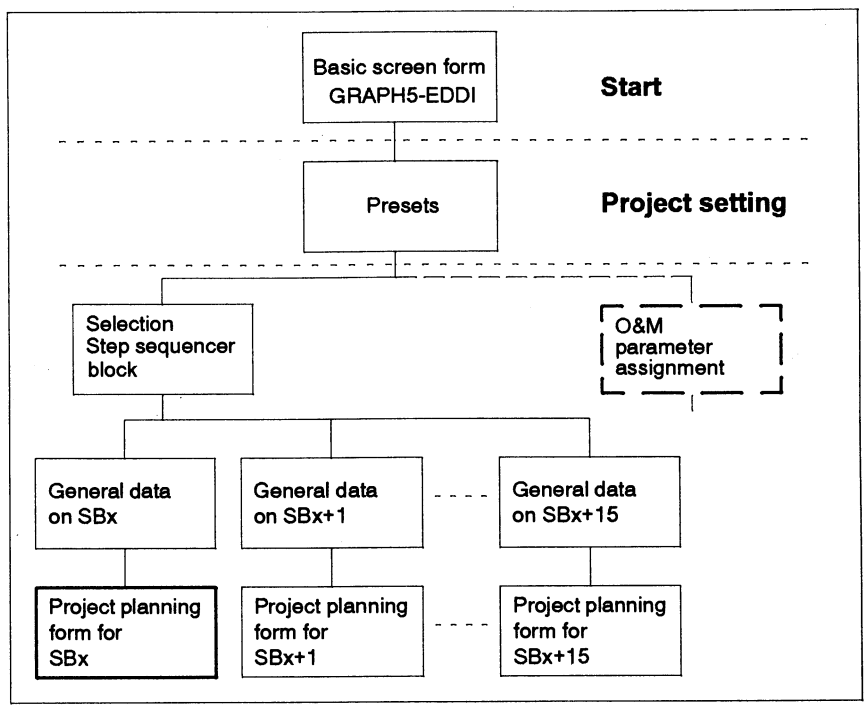
The G5E project planning software is divided into the subpackages

- GRAPH5-EDDI project planning and
- Parameter definition of the O&M interface to GRAPH5-EDDI.

An assignment list can be used in both subpackages.

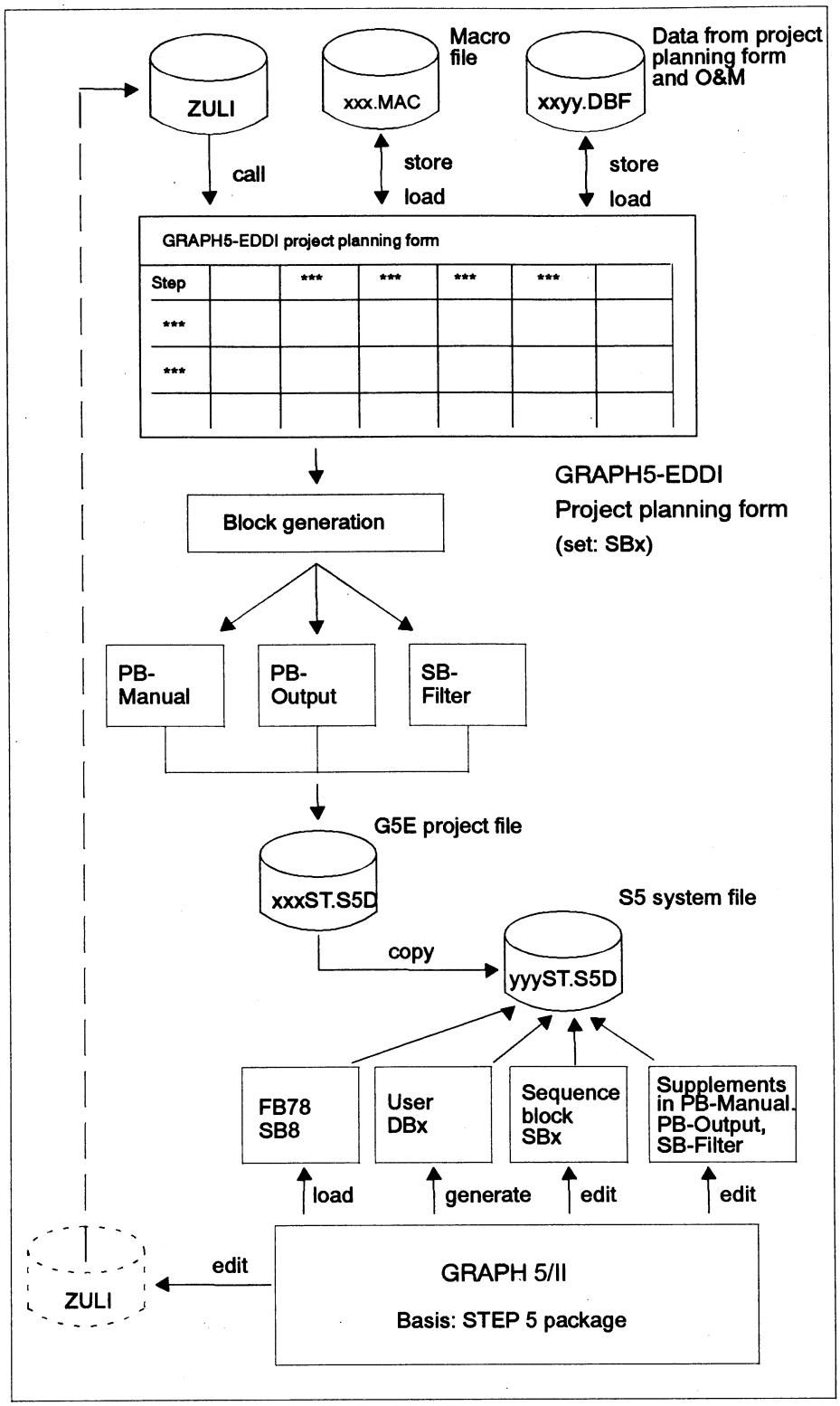
Overview of the screen forms

You have menu-guided access to the G5E functions via corresponding task-related screen forms.
At the fifth screen form level GRAPH5-EDDI opens the project planning form for programming the step sequencer SBx:



Editing task and program generation

The following diagram illustrates the generation of an entire program for a sequential control system using the GRAPH5-EDDI project planning software. As already mentioned in Section 1.1 and shown in the diagram, parts of the program (user DB, step sequencer SB) must be created with the standard editors of GRAPH5/II.


ZULI
xxx.MAC
Macro file
xxyy.DBF
Data from project planning form and O&M
call
store
load
store
load
GRAPH5-EDDI project planning form
Step
***
***
***
***
***
***
***
Block generation
GRAPH5-EDDI
Project planning form
(set: SBx)
PB-Manual
PB-Output
SB-Filter
G5E project file
xxxST.S5D
S5 system file
copy
yyyST.S5D
FB78
SB8
User
DBx
Sequence block
SBx
Supplements in PB-Manual, PB-Output, SB-Filter
load
generate
edit
edit
edit
ZULI
GRAPH 5/II
Basis: STEP 5 package

Features and Method of Operation of GRAPH5-EDDI

2

2.1 Method of Operation and Features of Sequential Control Systems

Principle of the sequential control system

- A sequential control system (step sequencer) makes provision for the stepwise execution of procedures whose chronological sequence can be described as a controlled series of single steps.
- Having executed one step, the sequencer is enabled for the next step in accordance with central step-enabling criteria, such as the arrival at defined positions or the expiry of wait times or compliance with monitoring times.
- Each specific step execution in the system corresponds to an action element in the control program, in which the functions to be executed must normally have been freely programmed in LAD/CSF/STL.
- The step-by-step processing of the single steps, with precisely defined states prevailing at the beginning and end of each step, permits an accurate diagnosis of the process sequence in the event of faults.

Structure of the sequential control system

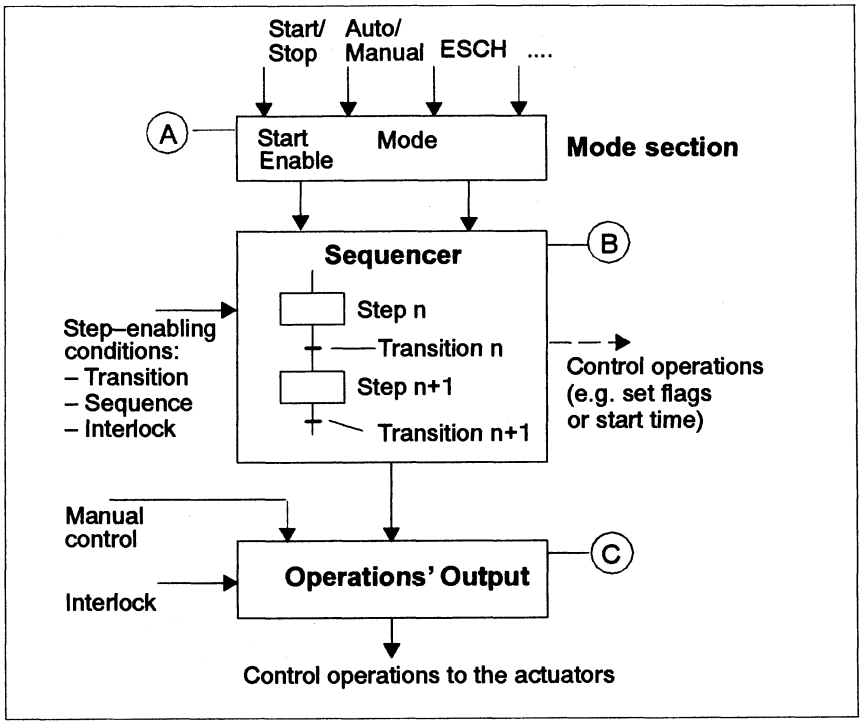
Each sequential control system comprises the following basic function elements:

A The "Mode section" in which specifications pertaining to the sequencer operating mode are recorded and processed;

B The "Sequencer" which, as a function of step-enabling conditions, resets the preceding step and makes preparations for setting the subsequent step;

C The "Operation output" in which the step operations of the sequencer are combined with the modes and interlock signals.

The diagram illustrates the functional interaction of the central functions of a sequential control system in the automatic mode.



Special features of the GRAPH5-EDDI sequential control system

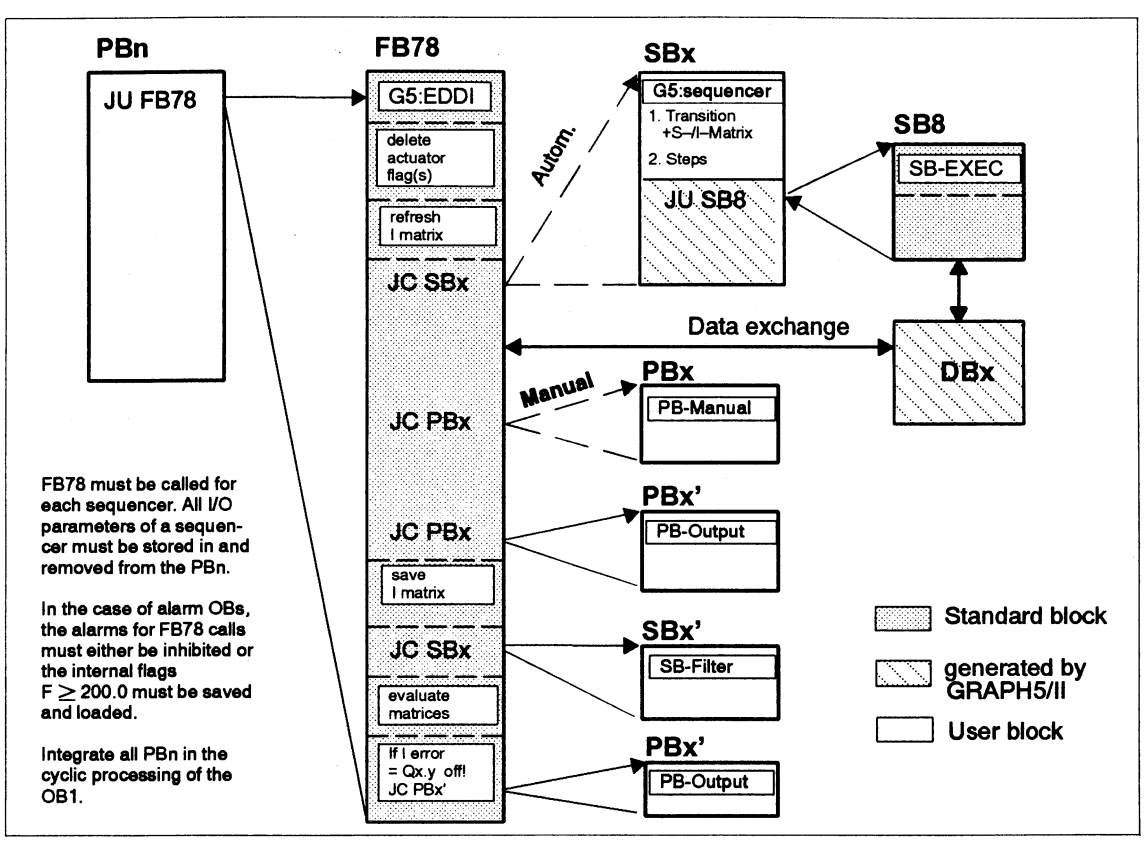
A G5E sequential control system comprises all the known elements of a standard sequential control system, but with the following vital differences:

- The signals and operations shown horizontally in the diagram, and used for enabling or disabling the step sequencer or for setting flags, are generated and processed automatically.
- Evaluation of the step-dependent flag assignments, pointing to the sequencer timeouts and step-enabling conditions used in the system (similar to transition conditions in GRAPH5) is effected automatically.
- The control functions (zoom-in function in GRAPH5), which are normally to be freely programmed, are to a large extent automatically generated.

Structure and functions of the GRAPH5-EDDI program

A G5E program which can run in the PLC for controlling process (e.g. movement) sequences is composed of eight SIMATIC blocks whose interaction is illustrated in the diagram below.

- Integrate all PB_n in OB1.
- The programmer must call FB78 in PB_n. All input/output parameters of the sequencer must be programmed here. The two standard blocks "FB78" and "SB8" then take charge of the cyclic processing of the control system in the programmable controller
- The specific behavior of the sequencer is stored in the user blocks PB-MANUAL, PB-OUTPUT and SB-FILTER generated by G5E.
- The user DB contains parameterized information or information stored by the system on step count, priority of recorded errors, sequence and interlock messages as well as on the current mode.



2.2 Functions and Modes of the Sequencer GRAPH5-EDDI

GRAPH5-EDDI modes: overview

The sequencer modes possible are implemented in the function block FB78 (Overview –> Table). They are mutually interlocked and assigned priorities. The priority determines which mode is active, should several be incorrectly selected at the same time. The priority marked with "x" indicates that only this mode may be activated.

Mode	Select via parameters FB78 or data bit in the user DB	Priority
Off (RESET)	OFF	1
Manual	MANUAL	2
Step search	DW 139, Bit 8 = 1	x
Single step no actions	DW 139, Bit 9 = 1 (ESCHoA)	x
Single step with actions	ESCH	x
Select step	DW 139, Bit 10 = 1 (SANW)	x
Single phase	ETKT	x
Guided manual operation	DW 139, Bit 7 = 1	x
Automatic	AUTO	x

Starting the mode

FB78 displays in display word DW 252 when a mode has to be taken over by an automatic start (A-ST).

The parameter A-ST is a software substitute for a self-latching contact which is interrupted by the priority modes OFF or MANUAL or by an interlock error.

In principle all formal operands (input/output parameters) of the FB78 can be selected or displayed alternatively via the user DB. Hence, it is possible to also define parameters easily for the "expanded modes" in the user DB (–> Table above).
The mode parameter definition in the user DB offers general advantages:

- Unnecessary parameters need not be observed in the DW (KH=0);
- All parameters can be operated and displayed directly via a single observation system (e.g. OP20, OP30, CP527, WF470,...).

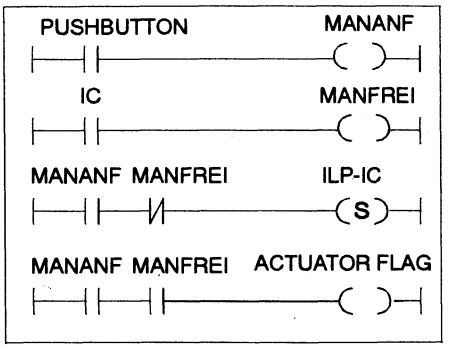
Mode: OFF

The OFF mode is immediately active after selection and resets the sequencer to step 0. All flags for the actuator position as well as the sequence and interlock messages are deleted.

Mode: MANUAL

The program in the PB-MANUAL is used for installing the machine/system. Each output, e.g. movement, can be activated e.g. via pushbuttons. Interlocked movements are not executed and the command is acknowledged by a corresponding message.

PB-MANUAL



Request for manual actuation (pushbutton)

Enable of the manual actuation on fulfilling the interlock condition IC

Diagnosis of the interlock

Setting the actuator flag and activation of the output (in the PB-Output)

The current sequence messages are constantly entered or cancelled, however, this does not apply to sequential errors. Via the user DB the interlock errors can be displayed in two ways:

- D138.1 = "1" display of only the MANUAL interlock (e.g. pushbutton actuated)
- D138.1 = "0" display of MANUAL and AUTO interlocks (e.g. not actuated → only AUTO interlock)

Mode: STEP SEARCH

If there is a positive edge at A-ST, beginning at the specification "Step search" (D139.8 = "1") FB78 searches for the next step which matches the current system image. The criterion for it is: "After switching to AUTO, step x has produced no interlock error".

The search process is conducted by the internal, stepwise setup of the I-matrix and constant comparison with the system image, with the actuator flags being switched off. As soon as the first step fulfilling the criteria is found, it is displayed and the sequencer is set to this step, together with the step's entire I-matrix.

Each further start with "A-ST" continues the search for the next possible step. If no step is found, the last active step is preserved together with its valid I-matrix.

Note: Using this mode one can scan all possible steps and if necessary complete the matrices so that after commissioning, without any ambiguity only one step can be found, i.e. so that the sequencer can be synchronized to the system image.

Mode: SINGLE STEP (no actions)

If you wish to switch your control system forward step by step without peripherals, this can be accomplished in this mode (Selection → Table above). No sequence messages (errors) and no interlock errors can occur or be displayed, only the wait times are active.

The outputs in the PB-OUTPUT are interlocked with the ESCHoA signal and all SLP/ILP messages are deleted cyclically in the SB-FILTER.

Mode: SINGLE STEP (with actions)

As in the automatic mode, the actions of a single processing step of the sequencer are performed in this mode.

Once the step-enabling conditions are fulfilled, the next step does not, however, become active. Instead, the output parameter T-OK (transition fulfilled) is displayed. An additional operation of T+1 (pos. edge) is needed to activate the following step.

Continued

Functions and Modes of the GRAPH5-EDDI Sequencer (cont.)

The input parameter T+1 is powered by the illuminated pushbutton and the lamp in the pushbutton is activated via T-OK. Only sequence messages (no sequence errors) and interlock errors can be entered or displayed. Only the wait times are active.

MODE: SELECT STEP

If you want to set the sequencer to a particular step, this can be done in this mode. To this end, enter the required step number in the user DB, DW 142. The outputs in PB-OUTPUT are interlocked with the SANW signal and all SLP/ILP messages are deleted cyclically in the SB-FILTER.

This mode must be re-activated on all occasions via A-ST, with the valid I-matrix being created up to the selected step. No sequence messages can occur or be displayed. Any existing interlock errors are not displayed until the step no. has been entered. Effect D 138.4 if you wish to prevent this. Wait and monitoring times are not active.

MODE: SINGLE PHASE

In this mode the system is operated with all automatic functions, in a single run, up to the position in step x which can be entered. To this end, enter the required step number, at which the step sequencer is to be stopped, into the user DB, DW 142.

Each further start with "A-ST" triggers another run. Sequence messages (errors) and interlock errors are entered and, if necessary, displayed. Likewise, all wait and monitoring times are active.

MODE: GUIDED MANUAL OPERATION

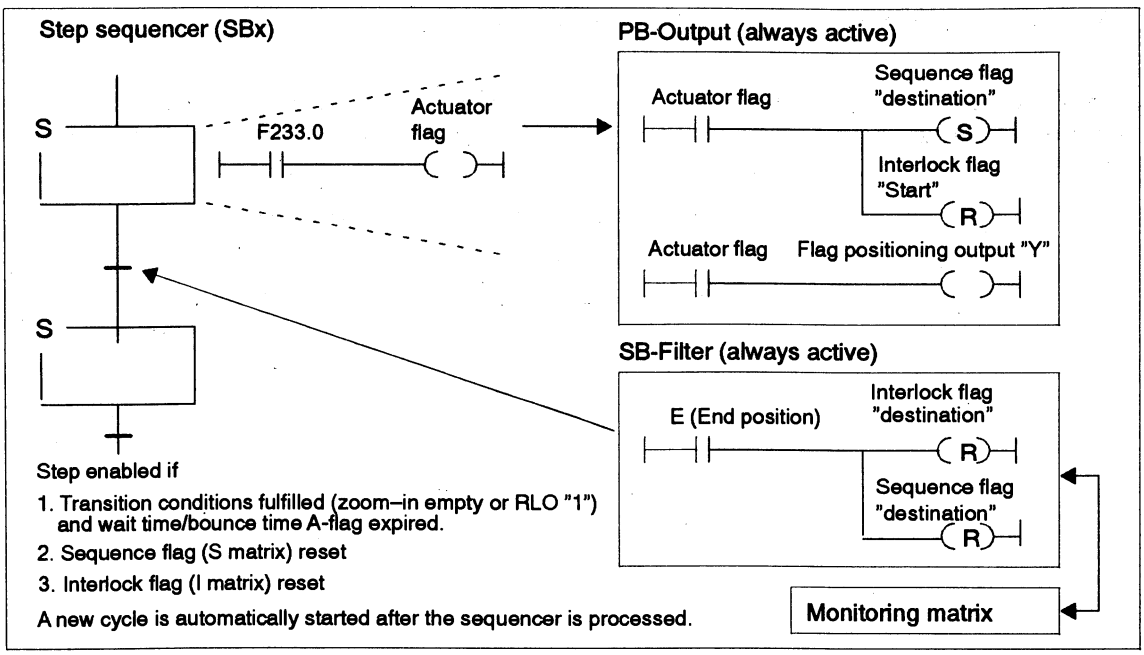
This mode permits a guided operation of the system with all automatic functions except for the monitoring times. The actuator flags must be placed in the PB-OUTPUT on pushbutton lamps. The associated pushbuttons then activate the output peripherals (actuators) in the PB-OUTPUT.

Only sequence messages (no sequence errors) and interlock errors can be entered and displayed. Only the wait times are active.

MODE: AUTOMATIC

The principal method of functioning of a G5E sequencer, while executing its automatic control activities, can be best demonstrated by reducing the functions to an absolute minimum.

1. The actuator flag corresponding to the sequence is set by the step sequencer. The flag F233.0 generated in GRAPH5 is then always 1 if the step is active.
2. The flags for the movement sequence "Destination" are then set in the PB-OUTPUT and reset for the "start" interlock. The positioning output is activated at the same time.
3. On reaching the end position (Ix.y = 1), the SB-FILTER deletes the sequence flag "Destination" and the I-flag for the movement sequence.
4. The criterion sequence flag "Destination" and interlock flag = 0 switches the sequencer forward to the next step.



Overview of modes:

Mode	Start signal produced by:	Monitoring and interlock	Actions of the plant/machine
OFF	-	-	Sequencer is set to step 0 and all actuator flags and SLP/ILP messages are deleted.
MANUAL	-	Cause is reported if active interlock.	A movement is effected per pushbutton if there can be no damage to the system (no interlock active).
STEP SEARCH	Pos. edge at A-ST	-	Synchronization of the sequencer to the system image
SINGLE STEP no act.	Pos. edge at A-ST and T+1	Only wait times active.	Step-by-step switch-forward without peripherals
SINGLE STEP with act.	Pos. edge at A-ST and T+1	Wait times, sequence monitoring and interlock active.	Step-by-step switch-forward with full interlock monitoring, active actions: and step-enabling condition. Output parameter T-OK is set at step end.
STEP SELCTION	Pos. edge at A-ST	-	The sequencer is set manually to a certain step.
SINGLE PHASE	Pos. edge at A-ST	Wait times, monitoring time as well as sequence and interlock monitoring active.	Single sequencer run up to the step whose no. has been parameterized in the DB (DW 142).
GUIDED MANUAL OPERATION	Pos. edge at A-ST	Wait times, sequence monitoring and interlock active.	Operation of the system with all automatic functions apart from the monitoring times, with the operator performing the specified movements.
AUTOMA-TIC	Pos. edge at A-ST	Wait, monitoring times as well as sequence and interlock monitoring active.	The sequencer is processed cyclically in uninterrupted operation.

2.3 Monitoring of Movement Sequences

Monitoring for sequence timeout (sequence matrix)

In each step of the sequential control system the current movement procedure is monitored for arrival at the end position and for its chronological behavior (wait time, monitoring time, bounce time of contacts).

The control system reacts as follows to a sequence message:

- the next sequencer step is not enabled;
- the mode and activation of the current step are preserved;
- the actuators remain activated until they have reached their end position.

A sequence timeout is issued if the monitoring time has expired and all pending end positions are recorded as possible error sources in the S-matrix. If the cause of the timeout has been eliminated and the error message acknowledged, the sequencer switches to the next step. This corresponds to sequence monitoring in GRAPH5.

Monitoring for interlock timeout (interlock matrix)

Apart from monitoring for a sequence free of timeouts, compliance with the associated interlock conditions is monitored during processing. A check is carried out to establish whether all the system states relevant for a reliable step sequence exist, i.e whether the system modules have assumed their planned position in the sequence up till now.

As soon as one of the monitored signals alters its state, an interlock timeout is issued and the control system reacts as follows:

- the AUTO-START signal on FB78 is reset during the step processing;
- the operation output in PB-OUTPUT is deleted;
- the mode and current steps are retained;
- all signals entered in the I-matrices are saved.

The sequencer switches to the next step once the interlock timeout has been eliminated and the timeout message acknowledged.

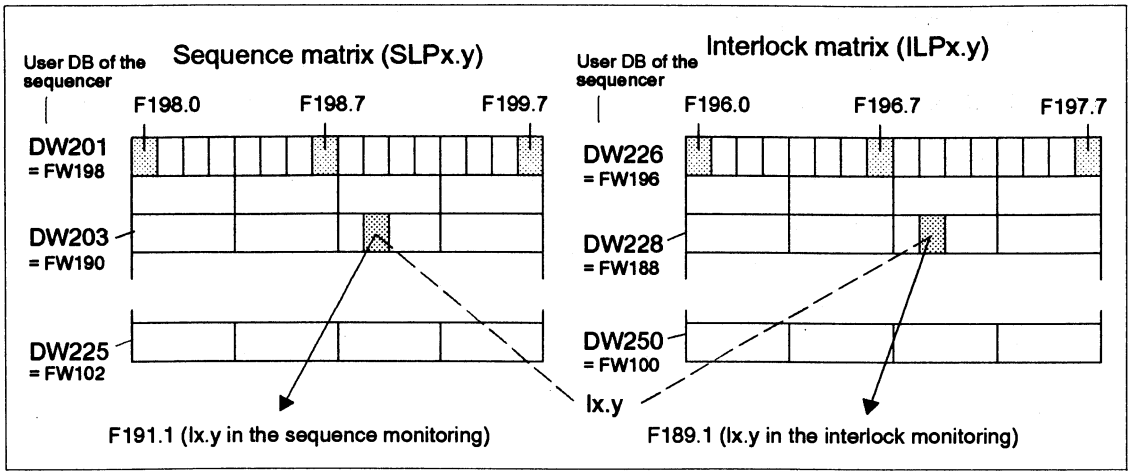
Organization of the monitoring

To organize the two types of monitoring, GRAPH5-EDDI sets up two matrices, for accommodating the sequence and interlock flags, with the following structural features (→ diagram).

- Each matrix forms a 16-bit wide flag field (→ following diagram).
- The assignment of the data words in the user DB on the matrices is continuously alternating. By virtue of the alternating assignment, the meaning of individual flag words is always the same irrespective of the matrix depth.
- The same assignment list (ZULI) can be used for various step sequencers.
- Automatic assignment of the flag bytes, beginning with F199.7 descending to F100.0, correspond to max. 25 matrix lines.
- Effective depth or number of lines of the matrices acc. to requirement and parameter definition on FB78 (parameter MLAE).

Structure of the GRAPH5-EDDI matrix

As illustrated in the diagram, both matrices are set up symmetrically to each other. The same matrix dot is assigned to a process signal (input Ix.y) in each of the two matrices.

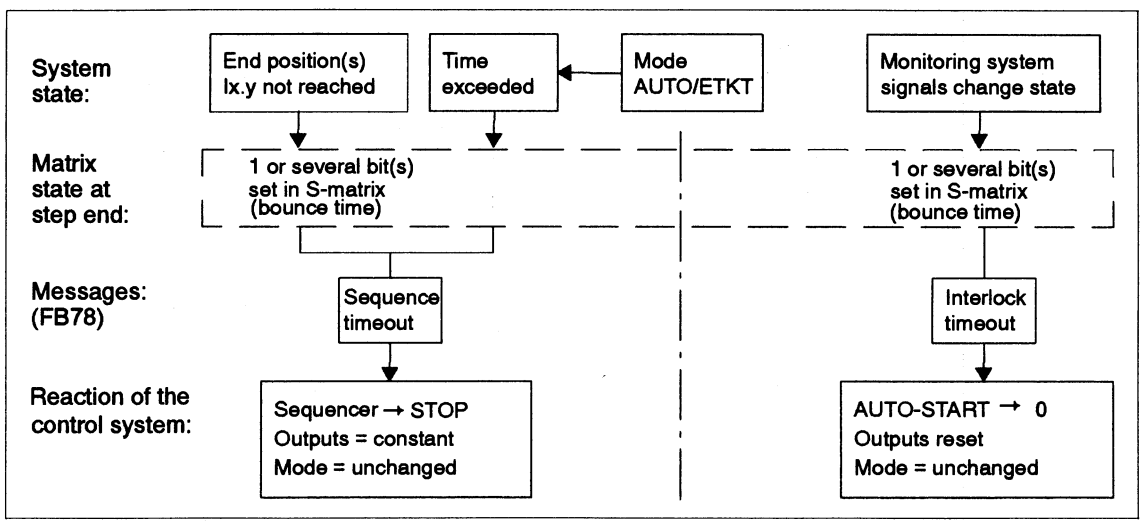


Method of operation of the GRAPH5-EDDI matrix

GRAPH5-EDDI's special features relating to the sequence monitoring and timeout diagnosis are based on its ability to depict the signal states of the system and on its stepwise updating in the matrices.

- By entering in the project planning form the reaction/end position signals in one or several lines for a step, you decide whether one or several bits are set in the sequence matrix (S-matrix).
- The bits set in the S-matrix determine which system signals are included in the sequence monitoring.
- The bits set in the I-matrix indicate feedback signals monitored for interlock timeouts.
- At any given time, the monitoring flag bit for a system signal, here Ix.y, is set in only one of the two matrices.
- FB78 ensures that all signals, whose sequence is monitored, are included in the interlock monitoring during their further progression until they can explicitly be excluded from it. This facility assures a reliable diagnosis as monitoring of a signal cannot be forgotten.

The diagram illustrates the monitoring functions in conjunction with the matrix.



2.4 Functions of the Standard Blocks FB78 and SB8

Features of FB78

The function block FB78 constitutes the parameter interface of the control system to the sequencer.

Via the FB input parameters the project engineer defines

- the sequence block to be processed in each case,
- the mode of the respective step sequencer,
- the type of operator intervention,
- the limits of the actuators' and monitoring matrices' areas.

The FB output parameters provide essential information on the status and timeout of the step sequencer; on the following to be precise

- Readiness for operation in the single step mode (T-OK),
- Sequence timeout, i.e. monitoring time exceeded (ASTO),
- Interlock errors, i.e. occurrence of dangerous system states (VSTO),
- Errors in the software structure of the sequencer (ZUST),
- Current sequencer mode (ZUST).

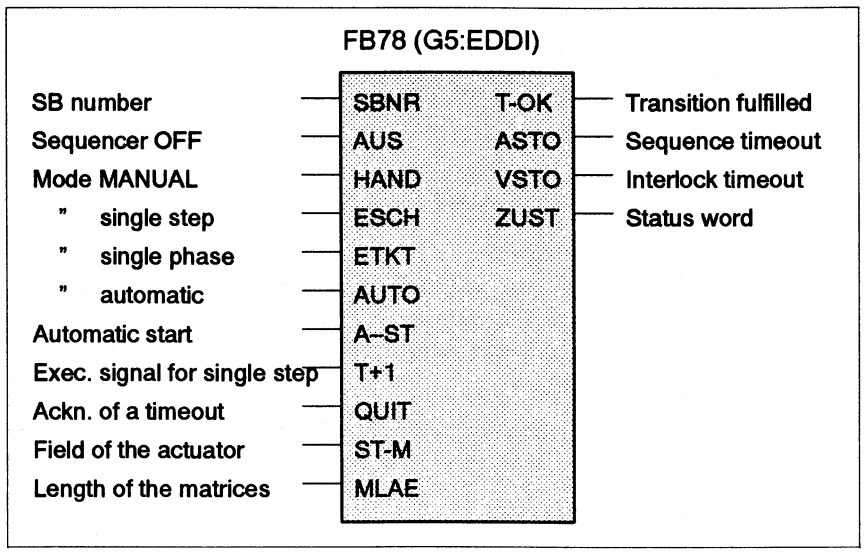
Technical data of FB78: Chap. 5.1

Duties performed by FB78

1. Deletes all actuator flags at beginning of cycle,
2. Sets all valid interlock flags (Basis: Refresh I-matrix DW 145 ... 193),
3. Calls the SBx of the parameterized sequencer in the automatic, single-phase or single-step modes or of the PB-MANUAL in the manual mode.
4. Calls the PB-OUTPUT and the SB-FILTER
5. If at least one interlock error still exists after processing the SB-FILTER, the PB-OUTPUT is immediately processed a second time (all actuator flags = 0).
   The sequencer is stopped and all outputs are withdrawn, i.e. the actuators are switched off.
6. After error elimination, by means of edge transition 0→1 in parameter A-ST processing of the sequencer can be resumed in the interrupted step.
7. The FB78 continues creating the currently valid interlock matrix acc. to the progression of the sequencer, beginning with step 0 (original state, I-matrix blank) up to the last step (currently valid I-matrix). Section 2.3
8. Parallel to the I-matrix update, FB78 (incl. the internally called blocks) enters data into and removes data from the user DB.
9. Constant supply/removal of data for certain standard flags F ≥ 200.0.

10. Entry of a code for the currently active block:
    0 = SB-SEQUENCER;
    1 = PB-MANUAL;
    2 = PB-OUTPUT;
    3 = SB-FILTER.

    Current messages are issued on the sequencer states and timeouts, based on flag bits copied in the user DB.



All other functions are to be activated via the user DB.

Duties of the SB8

Sequence block SB8 (SB-EXEC) makes the sequencer stop or switch forward. It receives the information it needs for processing the different step sequencers from the respective user DB or directly from FB78.

The prepared matrices are searched for any bits still set. If all bits are deleted in the S-matrix and in the I-matrix and if the specific wait time of the step has expired, the system-specific bounce time has expired and the monitoring time has not yet expired, the sequencer can be enabled for the next step.

SB8 performs the following activities in each step:

1. It calls up the information for processing the step sequencer from the user DB,
2. It checks the step-enabling conditions,
3. It deletes the step-active flag of the currently processed step
4. It sets the step-active flag of the following step.

2.5 Function of the User Blocks PB-OUTPUT, PB-MANUAL, SB-FILTER

PB-OUTPUT

Activation of the positioning output is programmed for both the manual and automatic modes in the program block PB-OUTPUT.

The following lines (segments) are generated by GRAPH5-EDDI (→ diagram):

1st line
The sequence flags "Destination" are planned such that the bit responsible for executing the respective sequence (confirmation of operation) is set in the S-matrix by the actuator flag.

2nd line
The "Start" flag bits for the start position monitoring of the system are deleted in the I-matrix by the actuator flag.

3rd line
Is only generated after creation of RSLP. This line is needed if the end position monitoring is to be switched off for one or several steps. The RSLP flag must be set in all steps in which the sequence monitoring should not be active.

Attention: To ensure that the RSLP is active only in the desired steps, RSLP must be present in the actuator flag field (parameter at FB78).

4th line
Conditioning of the actuator flags for all modes. The only difference exists in the case of "Guided manual operation" where only the associated pushbutton lamp is activated and the movement is carried out by the operator. Conversely, in the case of all other modes the movement is effected always via the actuator flag and the associated end position.

5th line
Activation of the lamp in the pushbutton for manual actuation:

- Permanently lit: End position reached
- Quick flashing: Movement through sequencer
- Slow flashing: Movement with guided manual operation
- Permanently lit: On triggering the central lamp test

The flashing frequency is generated by FB by setting and resetting the FLASH flag:

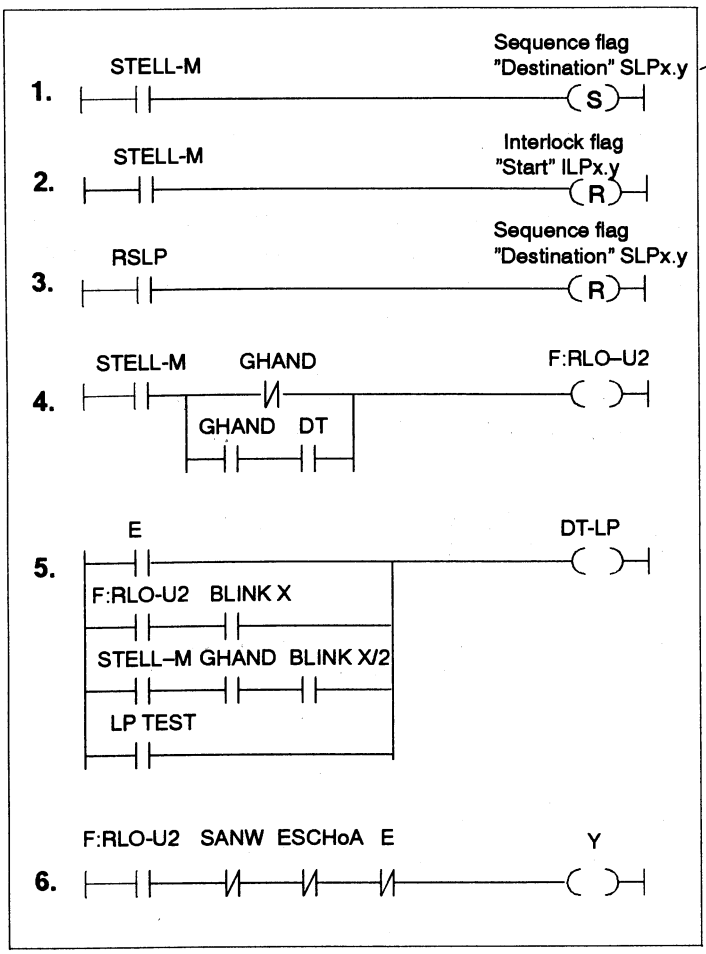
-FLASH X (F205.7): Flashing frequency X (Hz)
-FLASH X/2 (F206.0): Half flashing frequency X/2 (Hz)

Flashing frequency set in the user DB (DW 143) as a multiple of the cycle time.

The output DT-LP can also be used for showing the movement on a screen or display (e.g. flashing text).

6th line
The actuator flag, formed in the SB-Sequencer or PB-MANUAL, activates the controlling output via the RLO auxiliary flag.
-F:RLO-U1 (F204.6): = RLO carry flag 1
-F:RLO-U2 (F204.7): = RLO carry flag 2

In the case of certain actuators (e.g. motor drives) activation of the movement is interlocked with their end position. Additionally, all "expanded" modes (in the diagram: SANW and ESCHoA) are interlocked for the output.



PB-MANUAL

Activation of an action (e.g. movement) by a manual actuation is programmed in the program block PB-MANUAL. To terminate lines, a few scratchpad flags,which are newly composed in the different steps, are used.

- MANANF (F204.0): Request for manual actuator activation
- MANAUS (F204.2): Request for return movement in the case of signal valves (omitted with other actuators);
- MANFREI (F204.1): Enable of the manual actuation, taking the interlock conditions into consideration.

The following lines (segments) are generated by GRAPH5-EDDI:

Continued

Functions of the User Blocks PB-OUTPUT, PB-MANUAL, SB-FILTER (continued)

1st line
The request (triggering) of the manual activation of the output is programmed here. The pushbuttons for both direction of movements are mutually interlocked.

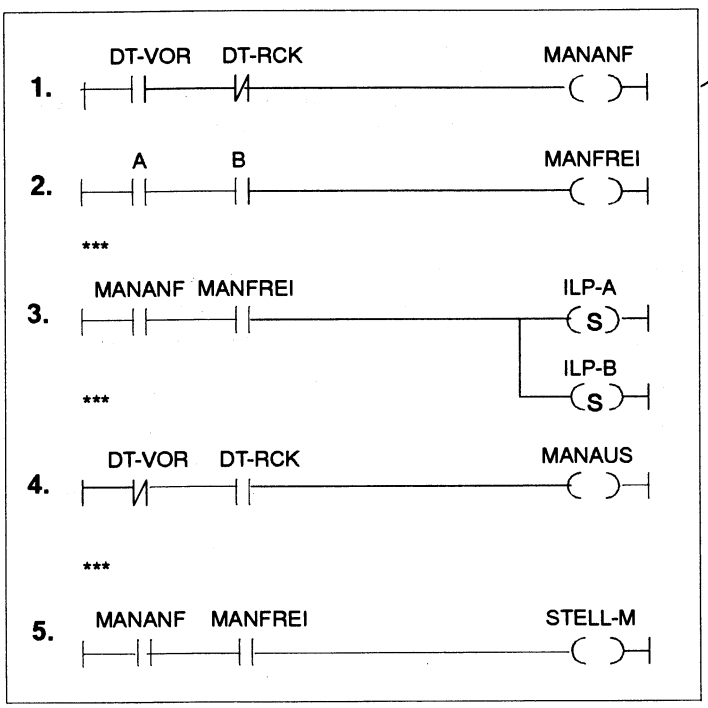
2nd line
Contains the interlocks which must be fulfilled during manual operation.

3rd line
If the requested movement is not enabled, corresponding interlock flags (bits in the I-matrix) are set here for the diagnostics. On actuation the pushbutton (DT), the operator obtains e.g. information on the missing end position or on any other interlocks of the activated movement.

4th line
If a signal valve is designed is an actuator, the return movement is programmed separately here (does not apply for other actuators).

5th line
If a request has been made and the manual actuation enabled, the associated actuator flag is activated (see PB-OUTPUT).

Note:
PB-MANUAL can be shortened or supplemented, with the logic combinations being correctly simplified. Minimum size: "BE" = no manual function.



Setting the manual request

Enabling the manual actuation (A, B = manual ILP)

Setting the diagnostic bits in the I matrix

Manual switch-off (only if requested, e.g. signal valve)

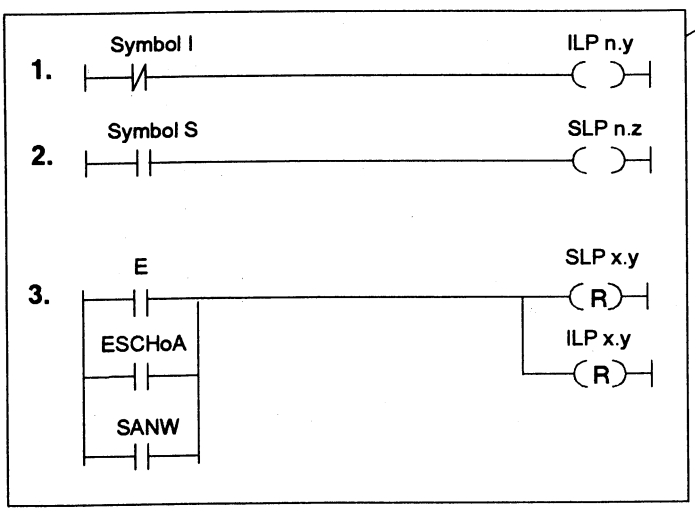
Assignment of the actuator flag in the case of manual request and existing Enable

SB-FILTER

In the sequence block SB-FILTER, generated by GRAPH5-EDDI in LAD, CSF or STL, the system states are processed by setting and monitoring the bit assignments in the sequence and interlock matrix.

1st/2nd line
The constantly monitored signals (e.g. EMER. OFF, BARRIER etc.) are, to begin with, programmed in the first lines. As soon as one of these signals has changed its state, the associated bit is set in the matrix.

3rd line
An individual line is programmed in the SB-FILTER for each of the other system signals (limit switches and other feedback signals) (see diagram).



Method of operation of the SB-FILTER

Deletion of the ILP assigned to the system signals is programmed for all limit switches. However, the assignment of the matrices is step-related, thus establishing a reference between the messages and the various processing steps.

All monitoring signals activated in the PB-OUTPUT and PB-MANUAL must be reset in the SB-FILTER. If a signal is forgotten, a message is issued during the system run.

Two points must be borne in mind as regards the monitored signals:

- Similar operands with a similar status monitoring are each assigned only one alarm bit in the S and in the I matrix.
- The respective input must be scanned for "1" or "0" depending on the status monitoring.

Continued

Functions of the User Blocks PB-OUTPUT, PB-MANUAL, SB-FILTER (continued)

Example:
I 1.0 should be monitored for "1", i.e. an interlock timeout should become active as soon as the status "0" occurs.

Program:	1. Constantly monitored:	AN I1.0 = -ILP 1.0
	2. Sequence-specific:	
	in the PB-OUTPUT	S SLP 1.0
	in the SB-FILTER	A I 1.0
		R SLP 1.0
		R ILP 1.0

After processing of the SB-FILTER, the S-matrix contains the codes for the current sequence messages (errors) and the I-matrix contains those for the current interlock errors. This bit pattern is saved in the user DB of the step sequencer for further evaluation.

Bit evaluation during the system sequence run:

1 If a movement does not reach its end position within the plant monitoring time, the sequence message becomes a sequence timeout message. FB78 stops switching the sequencer to the next step and displays the sequence error in the user DB.

2 If the observed limit switch is monitored for interlock in the next step, it produces the 1-signal if the operation has no timeouts. The SB-FILTER can therefore delete the associated bit in the I-matrix.

3 If, however, all bits of the I-matrix have not been deleted after processing by the SB-FILTER, all actuator flags are immediately switched off, the mode is deselected and the interlock error is displayed in the user DB.

Display of the sequence and timeout messages

All text and screen display units capable of reading data blocks from programmable controllers can be used for showing the message texts on a display. For certain selector functions e.g. mode selection, it is also necessary to write data into DBs (OP20, OP30, CP527, WF470, ...).

In the course of the project planning of the message displays, one message text is assigned to one bit of the data word in the user DB, i.e the respective bits of the flag word in the matrix concerned.

The texts are generally numbered if messages are output on a clear-text display unit. From the matrix bits, the programmer must then determine the message numbers to be transferred to the clear-text display unit.

Evaluating the monitoring matrices:

1. Display all messages

For evaluation on a screen, FB78 presents all messages, classified acc. to sequence and interlock matrix. The user DB acts as an interface to the sequencer for the display. One data bit is assigned to each SLP/ILP flag.

2. Display of the message with the highest priority

- FB78 searches through the matrices from top to bottom, beginning with the highest matrix line number.
- The FB78 stores in each DW of the user DB the line number and the bit pattern for the first matrix line in which at least one set bit has been found after this procedure.
- This mechanism applies for both matrices. In all cases it makes available the current interlock errors with the highest priority.
- An output interface, supplied with the current sequence/interlock message, has been installed in the user DB for transferring these messages to a computer or a control system.
- The first error with the highest priority is stored additionally in the user DB for subsequent diagnosis, until a new enable is granted via D138.3 or if the buffer itself is erased.

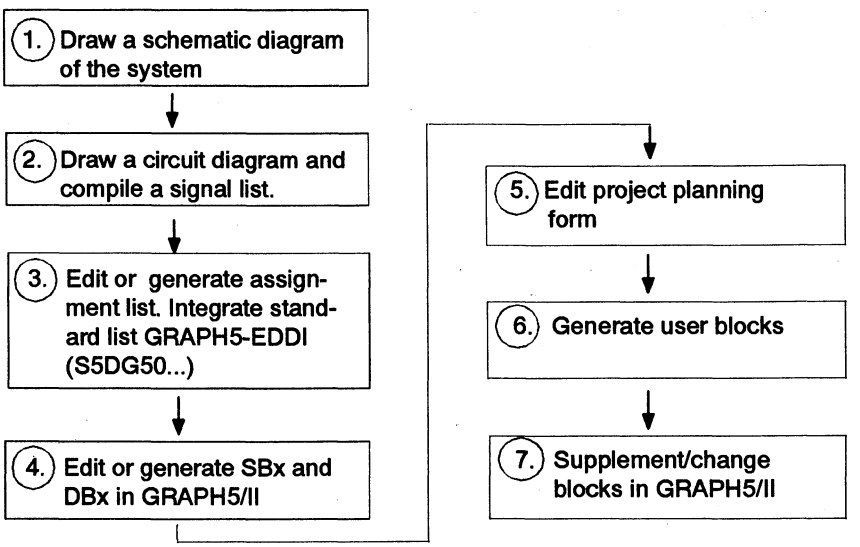
Using GRAPH5-EDDI

3

3.1 Planning a Sequential Control System

Creating a sequential control system

If you have a process sequence of the type described in section 1.2, then you can quickly and easily create the program for your step sequencer sequential control system with the SW package GRAPH5-EDDI. The following diagram and the nearby overview display illustrate the processing sequence for the program creation.



Preparing the editing session Steps 1...3

Completion of project planning steps 1 to 3 is assumed, although they are also shown in the processing sequence (next page) they are only dealt with briefly in the following text:

The matrix of the sequence and interlock flags is explained in Section 2.3, in respect of structure and functions. You must be conversant with this so-called G5E-matrix for your parameter definitions in the project planning form.

Section 2.3

Processing Step 4

The step sequencer block SBx is edited and processed in GRAPH5/II and the user data block DBx is also generated (–> associated manual). The assignment of the user DB supplied can be consulted in Section 5.2.

Section 3.2/ 5.2

Processing Step 5

Program the behavior and features of the sequential control system by compiling/filling out the G5E project planning form and by allocation of the S or I-matrix.

Section 3.5

Processing Step 6

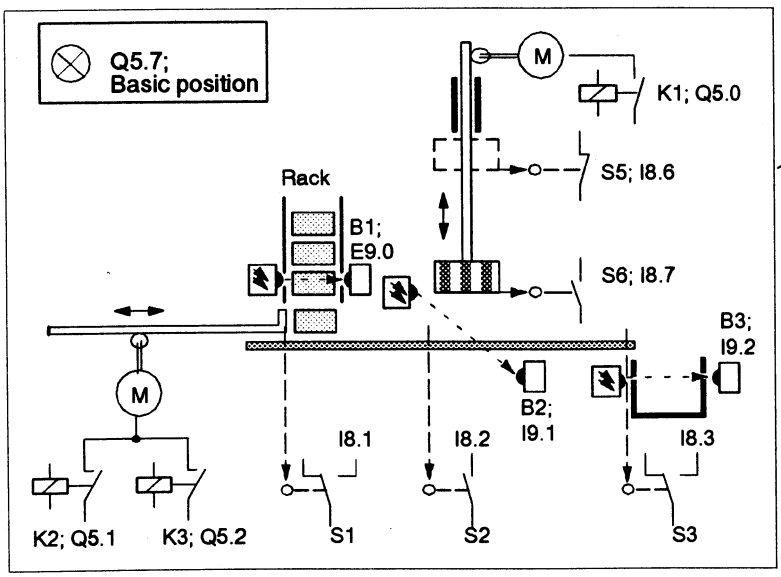
Create the user blocks PB-OUTPUT, PB-MANUAL and SB-FILTER via the G5E generation run. Compile a log of the project planning form and user blocks in G5E or GRAPH5/II.

Section 3.6

Processing Step 7

Make modifications to SBx in GRAPH5/II, and to the user blocks in the project planning form or in STEP 5.

Section 3.2



1. Draw a schematic diagram of the system
Here: embossing machine

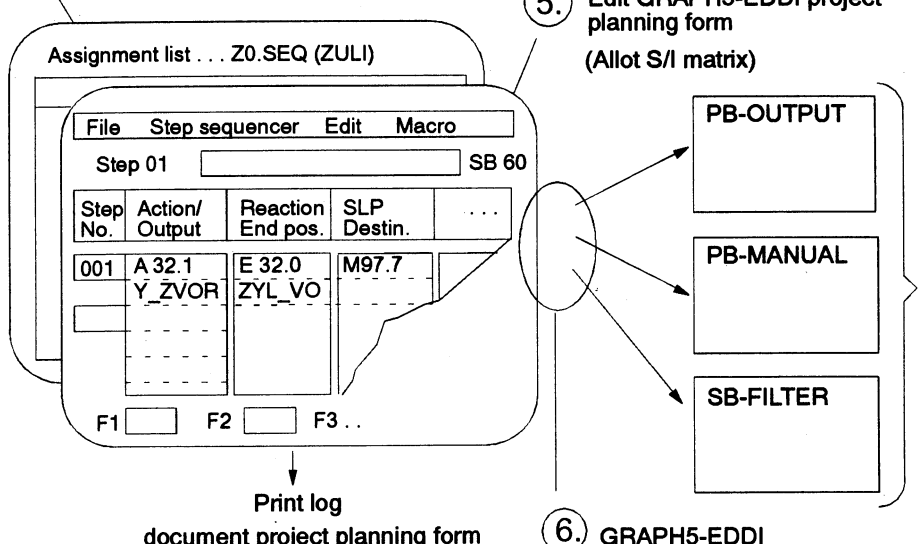
2. Compile signal list e.g. with HARDPRO

Process element	Operand		Comment
	absolute	symbolic	
Pushbutton	I 1.0	DTSV-P..2	
Limit switch	I 8.1	S1	Slide in GRST (pos. 1)
***			
Output	Q5.0	K1	Move stamp
Output	Q5.1	K2	Slide forwards

3. Edit or generate assignment list e.g. with HARDPRO

4. Plan sequencer with GRAPH5/II

5. Edit GRAPH5-EDDI project planning form
(Allot S/I matrix)



7. Complete blocks

Processing in
GRAPH5/II,
LAD
CSF
STL

Print log
document project planning form

6. GRAPH5-EDDI
Block generation

3.2 Steps Taken when Creating a Program

Structuring the control sequence

1. Divide the process into processing steps which can be clearly distinguished from each other.
2. Draw a pulse/time diagram to illustrate the interaction between the various actuators, do this, however, only if its customary and necessary.

   From this diagram one can easily recognize which actuators must be actuated for a processing step and which criteria (wait times or process conditions) must be fulfilled to move the step sequencer to the next step.
3. Graphic illustration of the step sequencer (based on standards IEC 1131-3, IEC 848). This also depicts the chronological/process-related sequence of the various processing steps.
4. Description and entry of the technological sequence in purely a commentary form, before the inputs/outputs are defined.

By temporarily assigning the different wait and monitoring times, this sequence can already be tested and discussed and be used as a basis for further clarification discussions.

Assignment of the I/O and compilation of the ZULI

1. The structure of the process provides the information needed for the type and number of inputs and outputs required.

Section 3.1

2. In accordance with the control system to be used, select appropriate peripheral modules and determine the addresses of the inputs/outputs.
3. Now based on the information available on the peripherals, compile an assignment list (in the GRAPH5 editor).

   A standardized assignment list (with max. possible entry of the SLPx.y as well ILPx.y of the assignment in the user DB) is available on your diskette. You may overlay this on your specific system ZULI and adapt it accordingly. File name: MUSTERZ0.SEQ.

Assignment lists can also be generated from the circuit diagram SW e.g. HARDPRO.

Programming the step sequencer

GRAPH5-EDDI supports the compilation of "linear" sequencers, including "Alternative branches" of these sequencers (-> figure).

Using the STEP 5 option package GRAPH5/II, create the graphic structure of the sequencer based on IEC 1131-3. All steps must be "selective" (symbol "S" in the graphics, preassigned by the editor).

1. In the first sequencer step, edit the start conditions by setting the associated bits in the S-matrix for all relevant signals.

   The program automatically enters these bits into the I-matrix of following steps.
2. If you wish to or must exclude certain signals (e.g. the start pushbutton) from the G5E automatic monitoring facilities, delete the associated bits in the I-matrix in the second step.

3. In the other sequencer steps merely allocate the actuators assigned to each movement. You may program several actuator flags (diagram) in one step. The step-active flag (F233.0) is generated by GRAPH5.

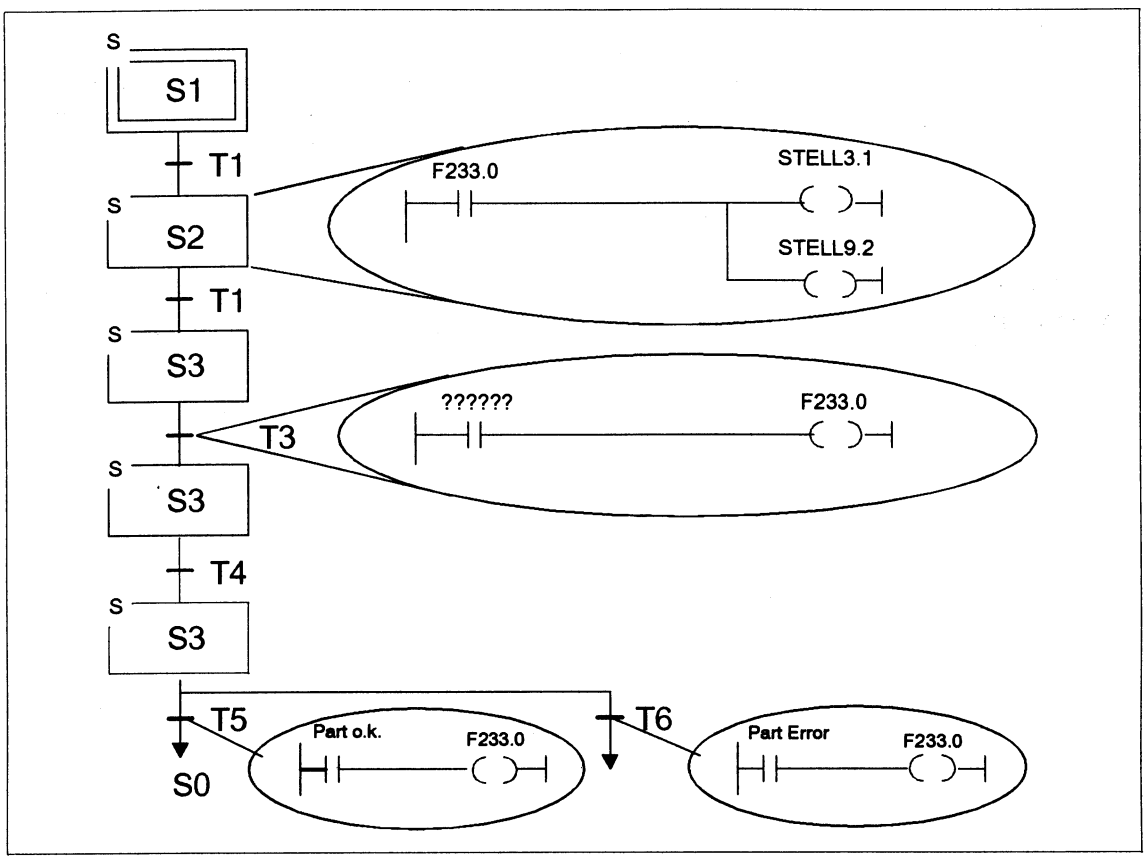
   If actuators are to be actuated via several steps, this can be effected in the multistep zoom "Search SL A, SL B etc." (see manual on GRAPH5/II).

4. Normally, transitions are not programmed for a G5E sequential control system. However, when opening an alternative branch, you must program the step-enabling conditions (see diagram for T5 and T6). If several transitions are fulfilled, the one on the far left is valid.

5. To terminate the sequencer, you may choose:

   a) END with jump to S0: valid I-matrix is deleted or

   b) END with jump >< S0: valid I-matrix is still valid.



Taking the limit switch bounce into consideration

When programming the sequencer, the negative influence of bouncing limit switches can be avoided by

1. Prolonging the step-specific wait time or
2. Entering a system specific-bounce time into the data word of the user DB, with separate entry for the S and I-matrix.

Continued

Steps Taken when Creating a Program (continued)

Sequence monitoring (S matrix)
Entry of a bounce time for the sequence monitoring causes a check to be carried out to establish when the step-enabling conditions are first fulfilled (possibly incl. expired wait time) and then restarts the wait timer of the step sequencer with the specified bounce time. Finally, after this time has expired the step sequencer switches to the next step.

Note:
The sequence messages are saved and entered with "ASTO" as sequence errors only for monitoring times.

Attention:
When monitoring for switch bounce, only sequence messages (no ASTO) and no sequence errors can be detected.

Interlock monitoring (I matrix)
When entering a bounce time for the interlock monitoring, a timer (user DB) especially parameterized for this purpose, is started in order to delay the shut-down of the system or to switch off bouncing of the limit switches. This check becomes effective as soon as at least one interlock timeout occurs for the first time.

Compilation of a project planning form

1. Enter general data (names, date etc.) and special modes of the sequencer.
2. Enter all specific detailed information on the system into the tabulated grid of the electronic project planning form.

   Pay attention to the evaluation of the priority list (set the lines: highest priority = last line) before beginning to assign the monitoring bits (SLP/ILP).

   For an observed sequence of movements (step), establish the relationship between the following signals (sequence of columns):

   1 Output (actuator) for the movement (Y),
   2 Reaction to the movement (end position = E),
   3/4 Bit in the S/I matrix (SLPx.y/ILPx.y),
   5 Flag for shutting off the sequence monitoring (RSLP),
   6 Actuator flag (AFx.y),
   7 Pushbutton (DT) for manual control of the movement,
   8 Output for the lamp in this pushbutton (DTL),
   9 Pushbutton for the counter-movement,
   10 Safety interlocks for the manual control,
   11 Supplement to include manual ILP not integrated in sequence (column 10...13),
   12 Integration of constantly monitored signals (further lines).

   With that, all signals and flags needed in the various modes for programming a movement are summarized clearly.
3. Generation of the user blocks
4. Copying the generated blocks into the system file!

The electronic project planning form is available as a SW package, incl. program generator, under MS-DOS on the PG/PC. A blank form is supplied with these instructions.

Section 5.3

Supplementing generated blocks

If you wish to supplement the user blocks, generated on the basis of the project planning form, please consult the block descriptions in Section 2.5.

Note:
Synchronization of different sequencers can be effected either via transition conditions or via sequence messages.

Integration in the cyclic processing

Generate or withdraw an FB78 call for each sequencer. This must be done in a PB (PBn) for all functions (–> program structure).

Section 2.1

Note:
Transfer the standard blocks FB78 and SB8 from the standard file (PLC-specific) to the S5 system file (yyyST.S5D).

Section 1.3

Processing sequencers created with older data

1. Call each sequencer (SBx) under the GRAPH5/II editor and store again. Check: The block length changes.
2. Call function DBGEN and regenerate all data blocks.
3. Transfer new FB78 and SB8 to the system file.
4. The modes and their parameters remain unchanged on the function block FB78. New functions can be implemented in the user DB via the data interface.
5. Expand the system software accordingly if new control functions are needed.

Section 2.2/2.5

6. With the system on HALT, transfer the new blocks to the respective programmable controllers and, to be on the safe side, execute the functions once.

3.3 Project Processing on the Programmable Controller

Installing GRAPH5-EDDI

▶ Load the software package "GRAPH5-EDDI" from diskette to the root directory or a subdirectory on your PG using the MS-DOS Copy function.

Starting GRAPH5-EDDI

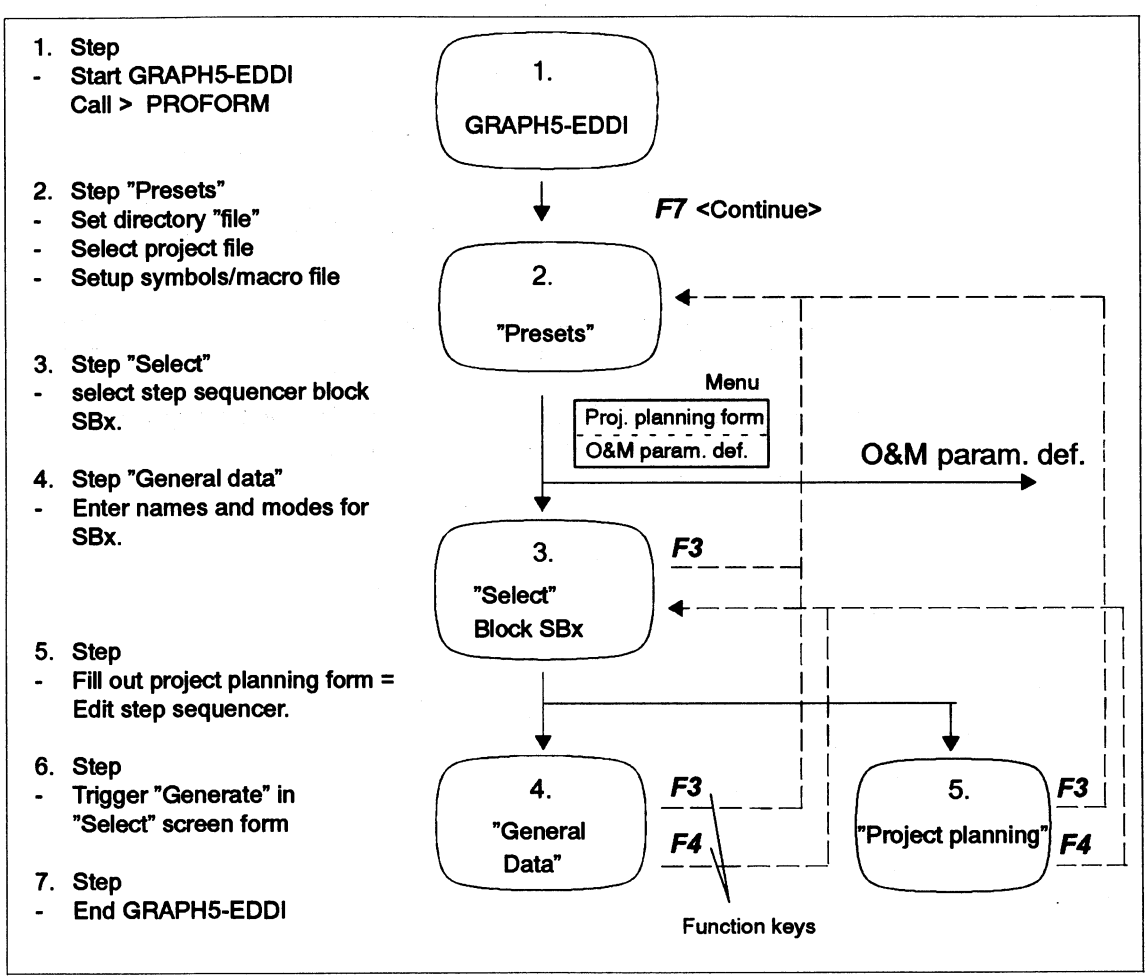
1. Start GRAPH5-EDDI by typing the character sequence "PROFORM" after the prompt (>).
2. After you have pressed <**Return**> the basic screen form appears, enabling you to identify the program. From here you can move to the Presets screen form with <**F7**>.

Session on the PG: "Project planning"

The diagram below illustrates the processing sequence for program creation with GRAPH5-EDDI on the PG/PC. If key <**F5**> of the system is assigned the function "Select", you can always access existing files via this key - when making entries into fields.

▶ Select the SW package branch "O&M parameter definition" in the "Presets" (2nd step).

▶ The project planning form can be called directly after entering the presets in the "Select" (3rd step) while circumventing the screen form "General data" (4th step).



Menu selection

▶ Select a menu or a menu item by placing the mouse pointer on the corresponding menu field and pressing the left mouse button ("Single click").

If not using a mouse

You may perform all functions via the keyboard also without a mouse:

1. The menu bar must be activated for this purpose.
   Changeover: <**F8**> or <**ESC**>. Display: F8 = "Edit".
2. Call the menu by entering, in each case, the initial letters highlighted in color.
3. Select a menu item using the specified numerical key or by selecting with the cursor keys <↑> and <↓> and confirming with <**RETURN**>.
4. Deselect an opened menu with <**ESC**>.

Help function key: <F1>

To facilitate editing, GRAPH5-EDDI presents you with

- help information on handling for many input fields
- and/or the data/value range permitted for the entry as soon as the cursor is in the respective field.

3.4 Selecting/Opening the Project Planning

Project presets

The following operating steps show you how to select/set up your project for processing in GRAPH5-EDDI:

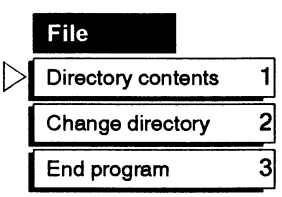
- Set/select user directory:
  Call functions in the menu field "File" of the screen form "Presets".
- Change user directory:
  Select function in the submenu "Change directory".
- Set up/end project:
  Make entries in the screen form "Presets".
- Select step sequencer block SBx:
  Make entry in the screen form "Select".

Setting up/ selecting user directory

If you wish to open/process your project in a "User directory" (= directory in which GRAPH5-EDDI has been loaded) other than that entered by the system in the screen form "Presets", you must change to the required directory in the menu field "File" and set up this directory as user directory.

1. Having called "Directory contents" in the "File" menu, enter a file name.

   G5E shows you the selected file/file group with file size (in bytes) and date of creation.



2. If you do not know the name of your user file, select **<OK>** in the window - without entering a name.

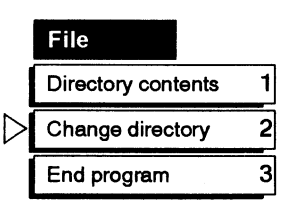
   G5E displays the table of contents (incl. subdirectories) of the current directory (name in the header line) and enables you to select a file.

3. Page with <Display> or <Display>. End with **<ESC>**. On selecting a subdirectory (called <DIR>), the respective subdirectory is displayed with **<OK>**.

Changing the user directory

1. Having called "Change directory" in the "File" menu enter the disk drive and directory name: DD:\Name.

   G5E accepts the search path entered or rejects the call with "Path not found".



2. Via **<ESC>** you enter a selected directory as user directory into the presets.

Setting up/ending the project

1. In the screen form "Presets", select the required project file after pressing <**F5**> in the selector window. G5E loads the selected project file for further processing.
2. You open a new project by specifying the corresponding file name (max. 6 characters) and ending with <**RETURN**>.

   A new project file is created after confirming the system query with [Yes].
3. If required, select the symbols (symbolic operand representation in the project planning form) by selecting the field [No] and pressing key <**F5**>.

   The field changes to the symbols [Yes].
4. If symbols [Yes], you must select via <**F5**> a symbols file in the user directory and assign it to the project with <**OK**>.
5. Having selected the field <macro file>, you can select a macro file in the user directory via <**F5**> and assign it with <**OK**> to the project.

   Otherwise, enter here the name for a new macro file to be created and end with <**RETURN**>. A new macro file is created after confirming the system query with [Yes].

Note: If you access existing files, the system makes copies (.BAK files) of them. Accordingly, you have at your disposal at all times the project status prior to the creation of a new version of your program.

Important: You may only quit the screen form "Presets" if a G5E project file has been entered.

▶ On selecting "End program" in the "File" menu, exit is possible at any time after confirmation of the system query.

Selecting step sequencer block

Since editing tasks in the project planning form of GRAPH5-EDDI always refer to a particular step sequencer and are assigned to the latter, the current step sequencer block must be named or be selected in the G5E project file for the processing/project planning.

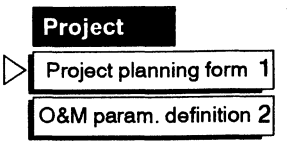
1. Having selected/pressed <**F4**>, the SBs (max. 16) in the project file are displayed in the "Select" screen form (red).
2. Enter the valid number (10...155) for the selected/new SB and end with <**RETURN**>. All subsequent names and processing activities are referred to the step sequencer block entered. The current SB no. appears on the upper right of the header in the project planning form.

Important: Project planning can only be effected after having entered a valid sequence block number in the screen form.

3.5 Editing the Project Planning Form for the Step Sequencer

Preconditions and initial tasks

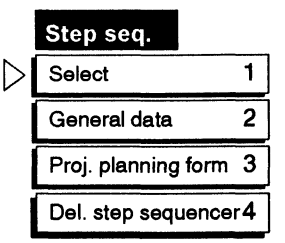
1. The screen form "Presets" has been opened.
2. The user directory has been set up and the project file selected or entered.
3. If available, the symbols and the assignment list to be used are selected.
4. If macros are needed, a macro file has been selected /entered.
5. Now under "Project" select the function "Project planning form".



Selecting the sequencer

The selected screen form opened (→ 3.3) by the system, displays all the step sequencers created so far in the project file (max. 16).

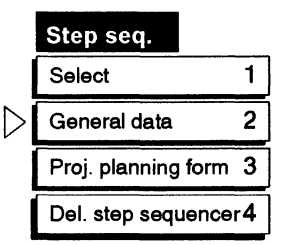
If a new sequencer is to be edited, you must enter a valid SB number into the field "Current step sequencer block" (overwrite any default setting) and end with **<RETURN>**.



Enter general step sequencer data

Having selected "General data" in the step sequencer menu you reach the respective project planning screen form of the selected sequence block.

Here you can edit all fields apart from the field with the SB number. For the program documentation enter the project name and other specifications for project identification.

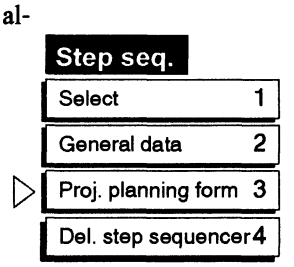


Important:
In the four operand fields (8 characters) you inform the step sequencer, via which input or flag the respective mode is to be initiated. Entries in these fields result in corresponding program modifications during block generation.

- Step selection — I a.b
- Guided manual operation — I c.d
- Step+1 no action — I e.h
- Lamp test — I f.o

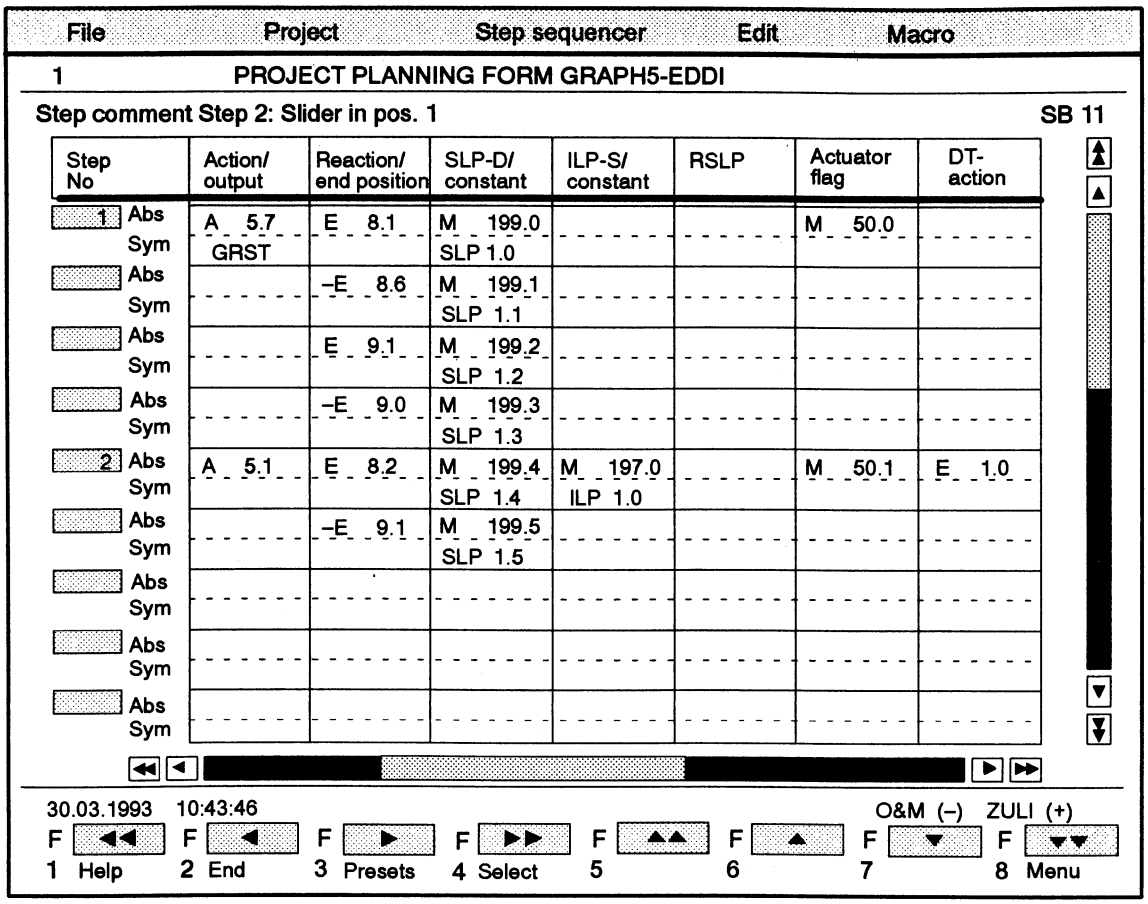
Navigation in the project planning form

On first calling the project planning form, the screen always depicts the extract of the display shown right.



▶ Move the form in a horizontal or vertical direction via the mouse buttons for the slider bars, or via the soft keys **<SHIFT F1>** to **<SHIFT F8>**.

- The column "step number" is not moved here (horizontal). There are altogether 13 operand columns.
- The slider bar displays (red) the form extract being shown.
- The line number containing the cursor is superimposed on the upper left.
- The relevant current step comment is displayed in the 2nd line from the top, even if the comment column is not displayed.



– Apart from the date and time, the system outputs the set functions O&M (–) and ZULI (+) in the message line (line above the soft keys). Non–projected functions are displayed by (–).

Note: in the project planning form you can only enter mnemonics in the German form. In the example above A stands for output (Q), E for input (I), and M for flag (F).

Editing the sequencer

The technological design is sequence-oriented.

▶ Enter operands absolutely or symbolically; if inverted with negative sign, into the fields of the corresponding lines (no blanks).

▶ Terminate each entry with **<RETURN>**.

– Entries outside the permitted value ranges for the absolute operands are rejected by the system with the message "Impermissible entry".

– Entries for symbolic operands not contained in the assignment list ZULI are not accepted. Message: "Symbols not found".

– If the system accepts the operand, the cursor jumps automatically to the next column of the respective line (current line no → upper left).

▶ Changing fields:
1. Horizontally to the right **<TAB>**; to the left: **<Shift>** + **<TAB>**.
2. Vertically: cursor keys <↓> or <↑>.

▶ If you wish to delete a field, place the cursor on this field and press the space bar and terminate with **<RETURN>**.

▶ Enter the explanatory text for each processing step of your step sequencer into the step comment field (max. 32 characters).

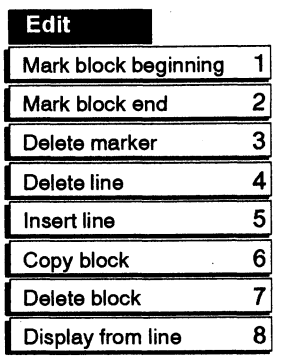
Continued

Editing the Project Planning Form for the Step Sequencer (continued)

- ▶ Assign the step number 999 a to constantly monitored signals.
- ▶ All manual ILPs must appear additionally in the end position column. List any supplements with step no. 998, with the corresponding SLPs having to be entered.
- ▶ One or several lines can be assigned to each processing step in the project planning form. A further line must be provided for each additional monitoring or interlock condition.
- ▶ Terminate editing by returning to "Select" and, if necessary enter a further SB.
  An explicit save or store is not necessary here.

Editing functions

GRAPH5-EDDI supports the project planning of your step sequencer with a range of editing functions permitting insertion and deletion of lines and line blocks in the project planning form.



Mark block (1/2/3)

Via block beginning/block end, you may mark individual lines or as many related lines as you wish for Copy or Delete operations.

- ▶ Set the markers by placing the cursor in the desired line and selecting the respective menu field.
  - – The marker is shown in the margin column on the left by an x (green). The marker is retained and moved when paging (scrolling).

Delete/insert line (4/5)

- ▶ If you wish to delete a line, place the cursor in this line and select menu function 4.
  - – The line containing the cursor is always deleted irrespective of any existing markings.
  - – Any existing markings are deleted.
- ▶ If you wish to insert a blank line place the cursor in the line, before which a new line is to be inserted, and select menu function 5. Any existing markings are deleted.

Copy/delete block (6/7)

- ▶ If you wish to copy a block, you must first mark the block lines contained in it.
- ▶ Place the cursor in the line, before which you want to insert the copied block, and select menu function 6.
- ▶ If you wish to delete the marked block, select function 7.

Attention: A deleted block is permanently lost. The function cannot be reversed.

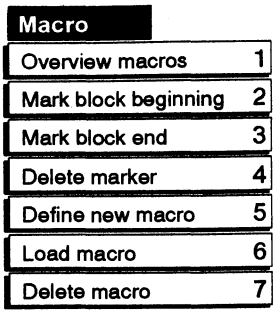
Display from line (8)

- ▶ If you wish to output the project planning form as from a certain line, select menu point 8 and enter the required line in the parameter definition window. After <**Return**> the project planning form is displayed as from the next line no.

Macro functions

GRAPH5-EDDI supports the creation and utilization of program macros. A macro consists of one or several (max. 50) lines of the project planning form.

For practical purposes, complete program steps are summarized for further use in a macro. On defining a macro, no check is, however, carried out to verify whether a step has been completed.



Overview macros (1)

Having called the menu field, G5E displays in a window the names of all macros available in the macro file set up.

Mark block (2/3/4)

Via block beginning/block end you may mark single or several related lines for defining macros.

▶ Set the marker by placing the cursor in the desired line and selecting the respective menu field.

– The marker is shown in the margin column on the left by an x (green). The marker is retained and moved when paging (scrolling).

Define new macros (5)

This function will only be executed if a block has first been marked.

▶ After selecting menu item 5, enter the name for the macro in the dialog window (max. 8 characters) and terminate with <**Return**>.

– G5E stores the marked line block under this name in the macro file (xxxxxxMC.DBF).

Load macro (6)

This function will only be executed if the cursor has first been placed in the line before which the macro is to be read in.

▶ Having selected menu item 6, enter in the dialog window the name (max. 8 characters) of the macro to be read and terminate with <**Return**>.

Attention: Pay attention to uppercase/lowercase letters when typing.

– G5E inserts the program lines contained in the named macro into the project planning form.

Delete macro (7)

Having selected the menu item, enter in the dialog window the name of the macro to be deleted and terminate with <**Return**>.

– G5E removes the respective macro from the file.

Attention: A macro deleted after confirmation of the system query is permanently lost, the function cannot be reversed.

3.6 Generating and Documenting User Blocks for the Step Sequencer

Further processing of the G5E program

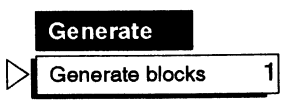
Having returned to the function "Select", you may effect the following processing steps.

Section 3.4

1. Create/process a further sequence block by entering the number of the respective block in the select screen and terminating with <**Return**>;
2. Generate the user blocks for the sequence block entered in the select screen;
3. Delete a sequence block from the project file;
4. Log the contents of the project planning form or also of the user blocks.

Trigger generation

In the "Select" screen you can trigger the automatic G5E generation process for the step sequencers of the project file.



▶ In the menu "Generate" select menu item 1 "Generate blocks".

– After long processing tasks (messages in the system message line), G5E generates the following blocks and stores them in the G5E project file xxxxxxST.S5D. (xxxxxx = Name of the project file).

- PBx [MANUAL]
- PBx+100 [OUTPUT]
- SBx+100 [FILTER]

Note: x indicates the number of each associated sequence block.

Important note

If GRAPH5–EDDI notices before the generation run that the G5E project file already exists, the following message is displayed:

"xxxxxxST.S5D already exists. Delete ?

For programming reasons the generated blocks can only be written into a blank file. Even blocks which have not been modified are regenerated during this process.

▶ If you want to retain your previous version, copy it into a project file with a different name.

▶ Select "Continue".

Delete sequence block

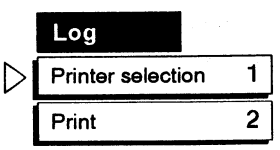
▶ If you want to delete one of the SBs entered in the select screen, select menu item 4 in the menu "Step sequencer" and confirm the system query for deleting the project planning form data with [Yes].

G5E cancels the entry for the respective block in the list in the select screen.

Output log

The data of the project planning form can only be printed out in landscape format (or in A3) and in compressed print (16.66 characters/inch). By virtue of the vast quantity of data in the project planning form this is necessary for legibility reasons.

▶ Select menu item 1 "Printer selection" and in the dialog window enter the control frequency data for switching your printer to landscape format and compressed print.



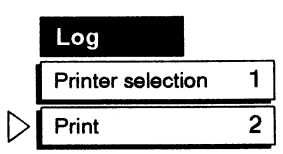
- The control characters are entered in any order in both lines.

▶ Enter the number of lines possible per page (e.g. for Siemens PT10: 041) and confirm your entries with <**OK**>.

Note: Verify whether your printer can print in landscape format. If this is not the case, a clear printout is not possible.

Trigger the print

▶ Start the print job for the step sequencer (SBx) set by selecting menu item 2 "Print".



- In a preliminary page, the printer log contains information on the step sequencer as found in the screen form "General data"; in one or several tabulated pages it contains the absolute, and in the case of ZULI (+) also the symbol operands, from the set assignment list, as found in the 13 columns of the project planning form.
- One line of the project planning form comprises 2 to 6 lines in the printer log, depending on the functional scope of GRAPH5-EDDI: ZULI (+/–) and O&M (+/–).

Log user blocks

If you want to make a printout of the user blocks generated by G5E, it can be done via the GRAPH5/II documentation function.

3.7 Present Information on the Operator Interface

Important

The O&M parameter definition provides a data block and text list assignment for the user program. Please check, by means of a simple example, whether this data offers you assistance with diagnosis and network operation (page 3–19).
The program for communicating with the SINEC L2 bus and for sending/fetching data from the generated interface should be created by the user. The user may also develop his own concept here.

Start "O&M parameter definition

1. Start GRAPH5-EDDI and select/setup project:

Section 3.4

2. Select O&M parameter definition <Yes> in the presets screen form.

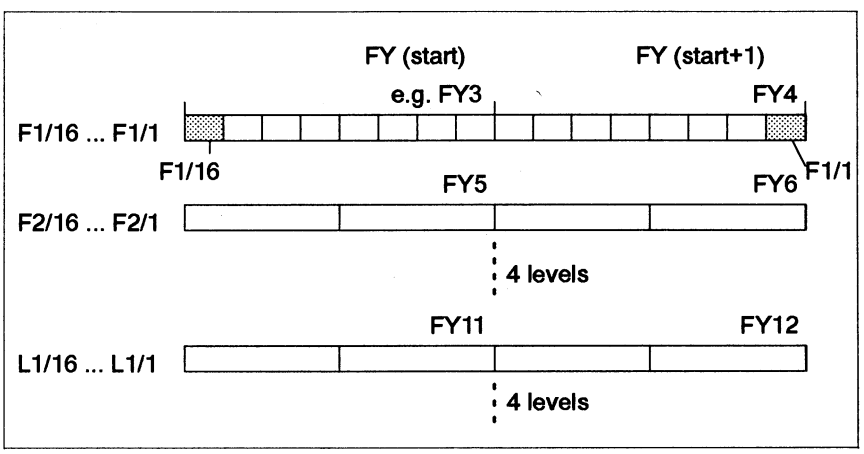
   In the window now visible entire the flag area [ ] – [ ] for the pushbutton (function keys on the operator panel) and the pushbutton lamps (LED on the operator panel).

   Attention: The flag area must always contain a multiple of 4 bytes (2 words / 1 manual level) (e.g. FY 0...3, FY 3...18 etc.).

3. Start the function "O&M parameter definition" in the menu "Project". The basic screen form for identification of the SW package appears. The line for system messages outputs instructions for internal generation and test sequences; you must wait until they have been output.

Enter flag area

Two flag words are needed for defining the functions (pushbuttons / lamps) of a manual level. Since max. 16 manual levels are possible, you can set up a flag area with max. 64 bytes acc. to the following pattern. Example: flag area = [3] – [18].



Area limits: FY start = 0...96, FY end = 3...159.
The DW99...DW131 of the user DB represents the interface to FB78.

O&M functions

Having initialized "O&M parameter definition" in the basic screen form, the O&M functions which can be selected appear in the menu bar:

- "Bus configuration"
  Menu item: "Bus parameter"
- "Step sequencers"
  Menu items: "Step sequencer data", "Step sequencer texts"
- "Assignments"
  Menu items: "Manual levels", "LP texts" (LP = lamp)

"Bus configuration"

Operator stations (e.g. OP30) are used for monitoring tasks and manual operations in G5E sequential control systems. Via the bus you may assign one or two operator stations to one or several CPUs with up to 16 step sequencers, with each having up to 16 manual levels.

Prepare bus configuration

To prepare data for the configuration, enter in the screen form "Bus parameter" your current bus addresses for the hardware being used as well as, if applicable, the step sequencer no. (SB No.) for the shuttle sequencer and the no. for the interface DB, if you wish to change the latter's default value.

1. Bus addresses for: 1st operator station [ ], 2nd operator station [ ]
2. Bus address of own CPU: [ ]
3. Bus address of CPU with the shuttle sequencer: [ ]
4. Bus addresses of (totally 4) alien CPUs: [ ], [ ], ...
5. Step sequencer no. of the shuttle sequencer: [ ]
6. DB no. of the interface block: [ ]

Shuttle sequencer = step sequencer for controlling the material transportation.

"Step sequencers"

In this menu the display and parameter definition of the step sequencer data and texts are branched for a CPU

- 16 step sequencers, each with 50 steps, are possible per CPU.
- The so-called shuttle sequencer, likewise with 50 possible steps, can also be located additionally in one of the 5 CPUs.

Enter step sequencer data

In the screen form "Step sequencer data", the numbers of the existing step sequencer blocks (max. 16 in one project file) are output for the respective sequencer, together with the number of manual levels (max. 16).

▶ Here you may enter station numbers for existing step sequencers (0...255).

By station number we mean a technology-related designation number, describing a functional unit of several related step sequencers as a "technological station".

Continued

Present Information on the Operator Interface (continued)

Enter step texts

Text comments on individual steps of the control sequence can be edited in the screen form "Step texts". Up to 50 step texts, each with up to 70 characters, are possible.

1. Via the input field "Step sequencer" [ ], select the sequencer (no. 1...16) or shuttle sequencer (no. 0) whose step texts you intend processing.
2. If you have entered step comments (max. 32 characters) in the project planning form, these comments appear here as "Step text" under the resp. step no.
   A prerequisite here: no block must have been generated yet. Otherwise, "Default" texts are output. You may supplement or overwrite these texts.
3. In the fields "Step text" enter the text, assigned in each case to one sequence step, which is to be displayed on the operator station.
4. Enter a typed text with <**Return**>. Existing texts can be overwritten.

The texts of the shuttle sequencer 0 and of sequencers 1 to 16 are only generated if the respective sequencer exists.

Paging in the screen form step texts

▶ You can page or scroll in the succeeding or preceding areas of the screen form via the corresponding mouse buttons on the right of the slider bar or via soft key operation <**SHIFT F5**> to <**SHIFT F8**>.

"Assignments" for manual operation via operator station

From this menu branches are made to the parameter definition of the manual levels or to the project planning of the lamp texts. These settings will enable you to operate from the operator station the projected step sequencers in the "Manual operation" or in the "Guided manual operation".

Enter manual levels

By entering a step sequencer no [ ], other than the preassigned one, you open the screen form for another sequence block (SB) whose number is shown on the upper right (red).

The number of manual levels is determined by flag area definition in the screen form "Presets". The same applies for the assignment of the flag words to the pushbuttons and lamps.

▶ Typing the manual level number and <**Return**> switches the display to the required level.

▶ Selection of the field [display] with the cursor switches the screen form from area F1...F8 to area F9...F16 and vice versa.

Enter lamp (LP) texts

You can edit lamp comments on the various steps of the control sequence in the screen form "LP texts". Using the entire flag area available, up to 25 x 16 LP texts, each with max. 70 characters, are possible.

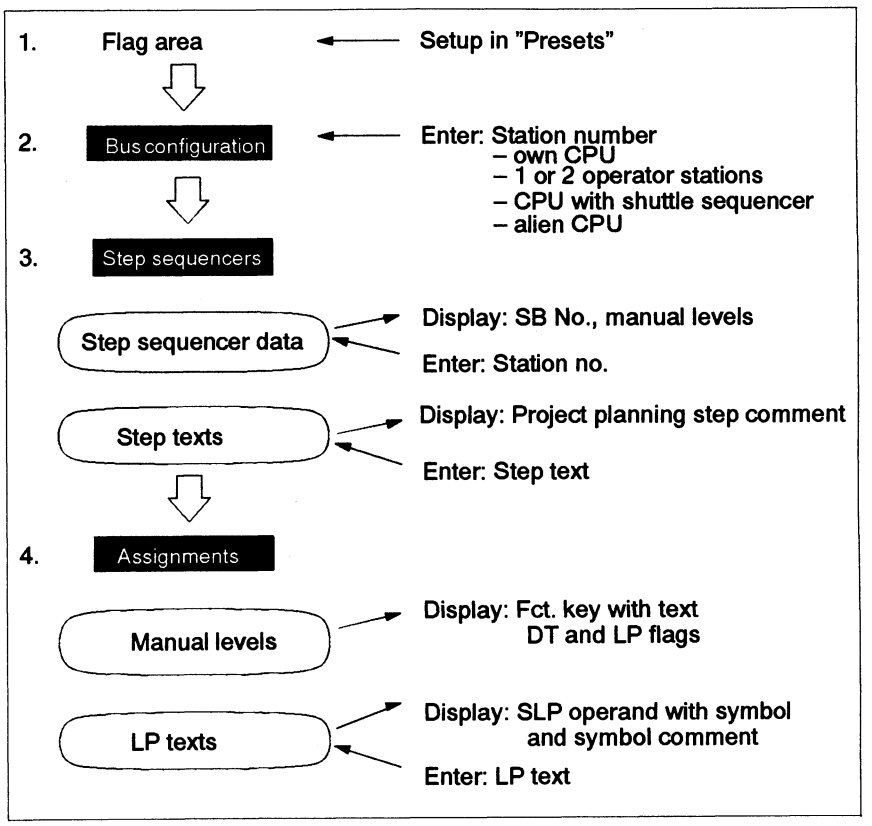
If the symbols are switched on (ZULI(+)), the symbolic operands stored in the assignment list appear in the screen form for the displayed operand "SLP-Destination".

1. Via the input field "Step sequencer" [ ], select the sequencer (no. 1...16) or shuttle sequencer (no. 0) whose texts you intend processing.
2. If the assignment list contains operand comments on the sequence flags, these comments appear here as "LP text" under the respective flag bit no.
3. In the fields "LP text" enter the text, assigned to one sequence flag, which is to be displayed on the operator station.
4. Enter a typed text with <**Return**>.

The texts of the shuttle sequencer 0 and of the sequencers 1 to 16 are only generated if the respective sequencer exists and the flag area preset has sufficient space.

Summary O&M functions

The following diagram summarizes the tasks needed for O&M parameter definition.



Example: Creating a GRAPH5-EDDI Program

4

4.1 Task Definition for a Program Example (Technological Concept)

Purpose and processing of the example

In this chapter we would like to show you the practical application and advantages of GRAPH5-EDDI based on a simple example for a sequential control system. Using the control task described below for an embossing machine we wish to

- offer newcomers an introduction to the project processing and handling of the GRAPH5-EDDI tool functions and
- grant practical users quicker access to the editing functions on the programmable controller.

If you wish to get to know GRAPH5-EDDI on the basis of the example for creating a sequential control system, we advise you to perform the described processing steps

- assignment list (ZULI) = edit signal list,
- edit sequence,
- edit project planning form (fill out),
- print log,
- generate and document blocks,
- supplement blocks,

yourself on your PG/PC. To this effect, create a new project file und the name BEISPLST.S5D and set up your program, created for practising in this initially blank file.

If you wish to make comparisons you will find the generated example program MUSTERST.S5D (not yet runnable) in your user directory (supplied with GRAPH5-EDDI). The program which is designed to run in the S5-115U can be found under the name ANLAGE.S5D, for which the assignment list "MUSTER..." is also valid. See Section 4.4 (page 4–12) for further important information.

Description of the example

The functional sequence of a simple embossing machine (see diagram), including the introduction and discharging of the workpiece, is to be automatically controlled and monitored.

The individual tasks performed by the system are:

1. A blank is placed from the rack beneath the stamp with the embossing tool.
2. The blank is embossed after the downwards movement of the stamp. The embossing time is 3 seconds.
3. The embossing stamp is driven to the upper end position.
4. The finished workpiece is moved to the collecting container if the latter is empty.
5. The slide is moved back to its initial position. A new machine cycle can begin after checking the basic position.

Despite the simplicity of this manufacturing process, it calls for a certain control investment to ensure, on the one hand, a disturbance-free sequence and, on the other hand, to provide convenient operator functions for manual interventions, setting modes and status displays.

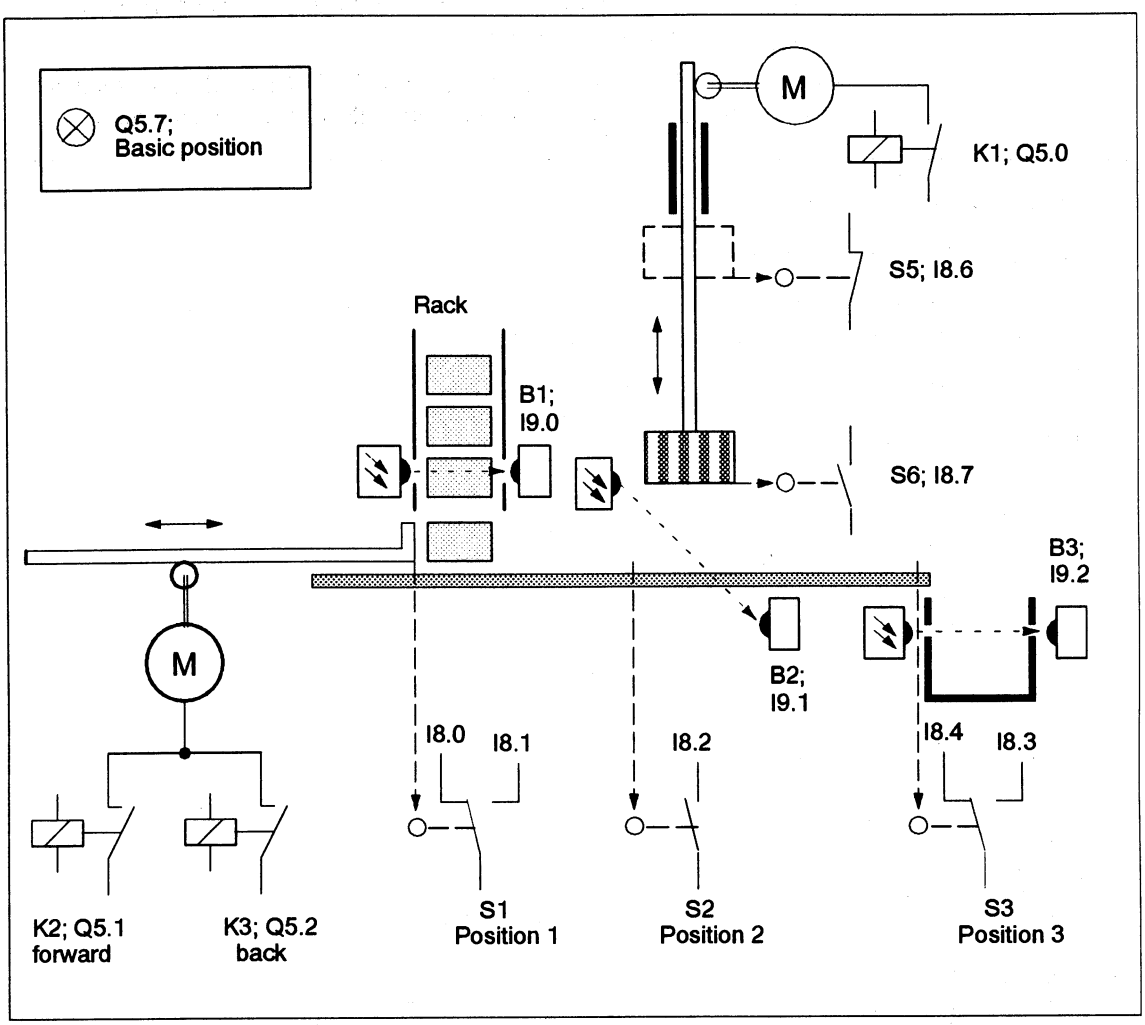
For reasons governed by the introductory nature and the transparency of our example, we would like, however, to concentrate in the following text only on the "automatic" sequence of the step sequence to be created.

You will see that GRAPH5-EDDI will significantly facilitate the necessary programming tasks by virtue of its specified project planning schema.

System schematic diagram

To prepare the program draft, the machine is depicted in such a manner that the system peripherals of the control system (sensors/actors) as well as their actions in the control sequence can be recognized.

For the logic operations in the PLC it is important to know how the sensor elements work. At the project planning stage, one must know whether a contact is an NO contact (normally opened) or an NC contact (normally closed).



The system diagram contains the information for listing the system inputs/outputs to be processed as operands by the control system.

Accordingly all data, which are transferred at the process interface to and from the control program, are known for compiling the signal list and processing the system sequences.

4.2 Compile Assignment List (= Signal List)

Compile assignment list or signal list

For a description and project planning of the process sequence as well as for the legibility of the program, it is advantageous to employ the input/output variables and flags in symbolic notation. To this end, you must compile an "Assignment list" (ZULI) as a preparation for further project planning.

1. In STEP 5 set up the project file BEISPLST.S5D and the symbols file BEISPLZ0.INI.
2. Call the STEP 5 editor "Assignment list" and type:
   under "Operand" the absolute operand name,
   under "Symbols" the symbolic operand name (max. 8 characters),
   under "Comment" the explanatory text on the respective operand.
3. Supplement the entries for the system I/Os with the actuator flags and flags in the monitoring matrices.

Having finished and saved the editing tasks, the ZULI should have something like the following setup (subset; operands in the project planning form):

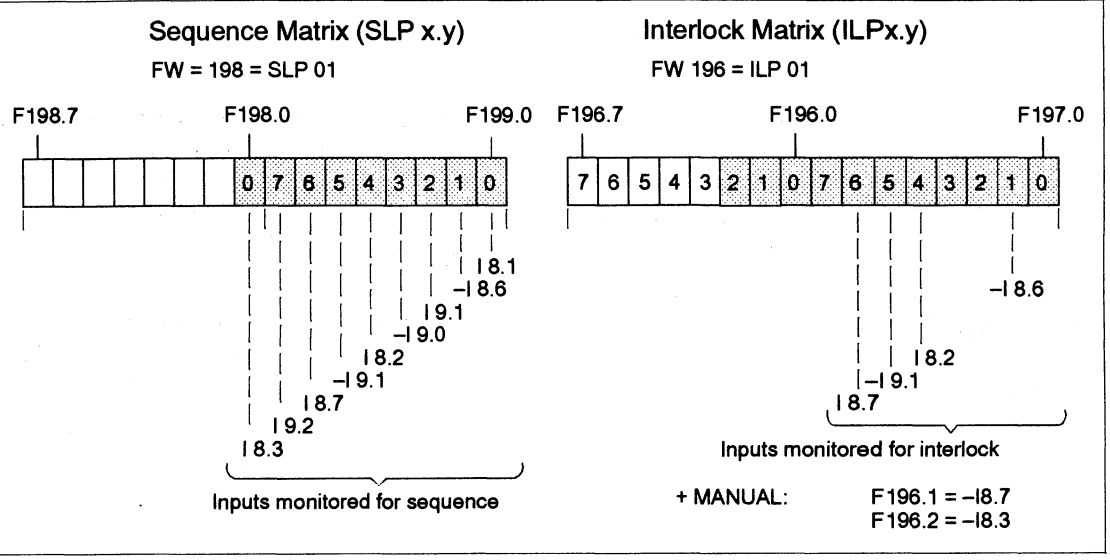
```
File: C: BEISPLZ0.SEQ

Operand  Symbol     Comment

I 1.0    DTSV-P.2   Pushbutton Slide forwards to position 2
I 1.1    DTSV-P.3   Pushbutton Slide forwards to position 3
I 1.2    DTST-AB    Pushbutton Stamp down
I 1.3    DTST-AUF   Pushbutton Stamp up
I 1.4    DTSZGRST   Pushbutton Slide back to basic position (P1)
I 1.6    LP-TEST    Lamp test

I 8.1    S1         Slide in basic position (pos. 1)
I 8.2    S2         Slide in front of stamp (pos. 2)
I 8.3    S3         Slide in end pos. (pos. 3)
I 8.6    S5         Stamp not up
I 8.7    S6         Stamp down
I 9.0    B1         LS1: Light barrier Rack empty
I 9.1    B2         LS2: Light barrier Blank not under stamp
I 9.2    B3         LS3: Light barrier Collecting container empty

I 10.0   SANW       Step selection mode
I 10.2   ESCHoA     ESCHoA mode no actions

Q 5.0    K1         Move stamp (K1)
Q 5.1    K2         Slide forwards (K2)
Q 5.2    K3         Slide back (K3)
Q 5.6    BEHLEER    Container must be emptied
Q 5.7    GRST       Embossing machine in basic position

F 50.0   YGRST      Basic position
F 50.1   SCH.P.2    Slide forwards to pos. 2 (in front of stamp)
F 50.2   S-AB       Stamp down for embossing job
F 50.3   S-AUF      Stamp up to upper end position
F 50.4   BEH-LEER   Request empty container
F 50.5   SCH.P.3    Slide in pos. 3 (end position before container)
F 50.6   SCH.GRST   Slide back to pos. 1 (basic position)
```

Continued →

```
continued:
Operand  Symbol    Comment

F 197.0  VLP1.0    Interlock Slide in pos. 1 (S1)
F 197.1  VLP1.1    Interlock Stamp up (S5)
F 197.2  VLP1.2    Interlock Slot beneath stamp empty (B2)
F 197.6  VLP1.6    Interlock Stamp down (S6)
F 197.7  VLP1.7    Interlock Container empty (B3)
F 196.0  VLP1.8    Interlock Slide in pos. 3 (S3)
F 196.1  VLP1.9    Interlock Stamp not down (S6)
F 196.2  VLP1.10   Interlock Slide not in pos. 3 (S3)

F 199.0  ALP1.0    Sequence Mon. Slide in pos. 1 (S1)
F 199.1  ALP1.1    Sequence Mon. Stamp up 1 (S5)
F 199.2  ALP1.2    Sequence Mon. Slot beneath stamp empty (B2)
F 199.3  ALP1.3    Sequence Mon. Rack not empty (B1)
F 199.4  ALP1.4    Sequence Mon. Slide in pos. 2 (S2)
F 199.5  ALP1.5    Sequence Mon. Slot beneath stamp occupied (B2)
F 199.6  ALP1.6    Sequence Mon. Stamp down (S6)
F 199.7  ALP1.7    Sequence Mon. Container empty (S3)
F 198.0  ALP1.8    Sequence Mon. Slide in position 3 (S3)

F 204.0  MANANF    Manual request
F 204.1  MANFREI   Manual enable
F 204.2  MANAUS    Manual switch-off
```

The following diagram shows the monitoring bits allocated in the matrices to the monitoring and interlock of the various function steps of the sequence.

Section 2.3



The assignment list contains only those operands required in our concrete example for describing operation. Please consult the file MUSTERZ0.SEQ supplied with inputs monitored for the example program MUSTERST.S5D for information of further mode and state parameters interlock required for the complete performance capabilities of the program.

4.3 Edit Project Planning Form (Fill Out)

Project planning "Presets"

To program the automatic machine cycle of an embossing machine described clearly in Section 4.1, the following tasks must be performed in GRAPH5-EDDI:

1. Start GRAPH5-EDDI in the root directory by entering the path or directly in the user directory with PROFORM.
2. If required, set up your user directory in the file menu.
3. Enter the file name for the example "BEISLP1.DBF" and quit the field with <**Return**>.
4. Now select symbols = "Yes" and load the symbols file "BEISPLZ0.SEQ".
5. In the project menu change to the function "Project planning form" and enter the block number of the step sequencer, here SB **60**. Terminate the entry with <**Return**>.
6. Now change in the step sequencer menu to the function "General data".

Project planning: "General data"

▶ Enter in this screen form the project name and the plant section name, to which the step sequencer to be created refers.

Proposal:

Project:	Example GRAPH5-EDDI
Plant section:	EMBOSSING MACHINE
Person responsible:	N.N.
Creation date:	dd.mm.yy
Step selection:	I 10.0
Guided man. operation:	I 10.1
Step + 1 no action:	I 10.2
Lamp test:	I 1.6

Now before you can begin to edit the project planning form, having changed to the next screen form, you must become familiar with all details of the control sequence to be planned. The next blocks "Description..." and "Overview of the automatic control functions" supply you with the information required for filling out the electronic form.

Description of the control functions

An important step for the program development is the definition of the detailed control sequence based on the system schematic diagram available (→ 4.1) and on the list of all process variables (→ 4.2).

The envisaged sequential control system (step sequencer) must implement, among others, the following functions:

1. Preparation of the program sequence required (calling the SB-sequencer)
2. Definition of the mode status (start-up code from OB)
3. Switching off the machine, stopping the function step (Emer. off)
4. Determination of the mode (input parameter on the FB78)

5. Output/display of mode status and sequence errors (output parameters on FB78)
6. Manual operation of individual machine functions (pushbuttons).
7. Movement towards the basic position.
8. Check of the initial state.

9..16. Automatic control of the function steps of a machine cycle.

Overview of the automatic control functions

As already agreed upon, to enhance transparency we shall limit ourselves in the further description of the example to only those functions, which are of relevance in the mode "Automatic", preceding section points 6 to 16.

The functional sequence of the described embossing machine can be summarized in tabulated form as follows.

Sequence step	Action/state of the embossing machine	Actuator	Sensor	Sequence mon.	Interlock monitoring
1 1.1 1.2 1.3 1.4	Check basic machine position. • The slide is in the basic position (pos. 1). • The stamp is in upper end position. • The embossing tool is free. • The rack is not empty.	Q5.7 (No.)	S1 -S5 B2 -B1	S1 -S5 B2 -B1	none " " "
2 2.1 2.2 2.3	The slide is moved forwards as long as • the switch S2 is not closed, • and the embossing position has not been reached, • and the tool is free.	K2	S2 -B2	S2 -B2	-S5 (Stamp up)
3	Lower stamp until the embossing position is reached.	K1	S6	S6	S2 (Switch in Pos. 2) -B2 (Tool free)
4	Let embossing time expire (3 s in SB60).				S2 -B2 S6
5	Move stamp upwards until the upper end position is reached.	K1	-S5	S1	S2 -B2
6	Request to empty the collecting container: Output Q5.6 active until container is empty.	Q5.6	B3	B3	S2 -B2
7	Discharge of the workpiece: Slide is moved forward until pos. 3 is reached.	K2	S3	B3	none
8	Machine moves towards basic position: Slide is moved backwards until pos. 3 is reached.	K3	S1 -S6 -S3	S1	none

It must also be possible to activate manually via pushbutton machine movements of steps 2 and 3 as well as steps 5 to 8, with in each case one pushbutton being designed for movement and counter-movement

Continued

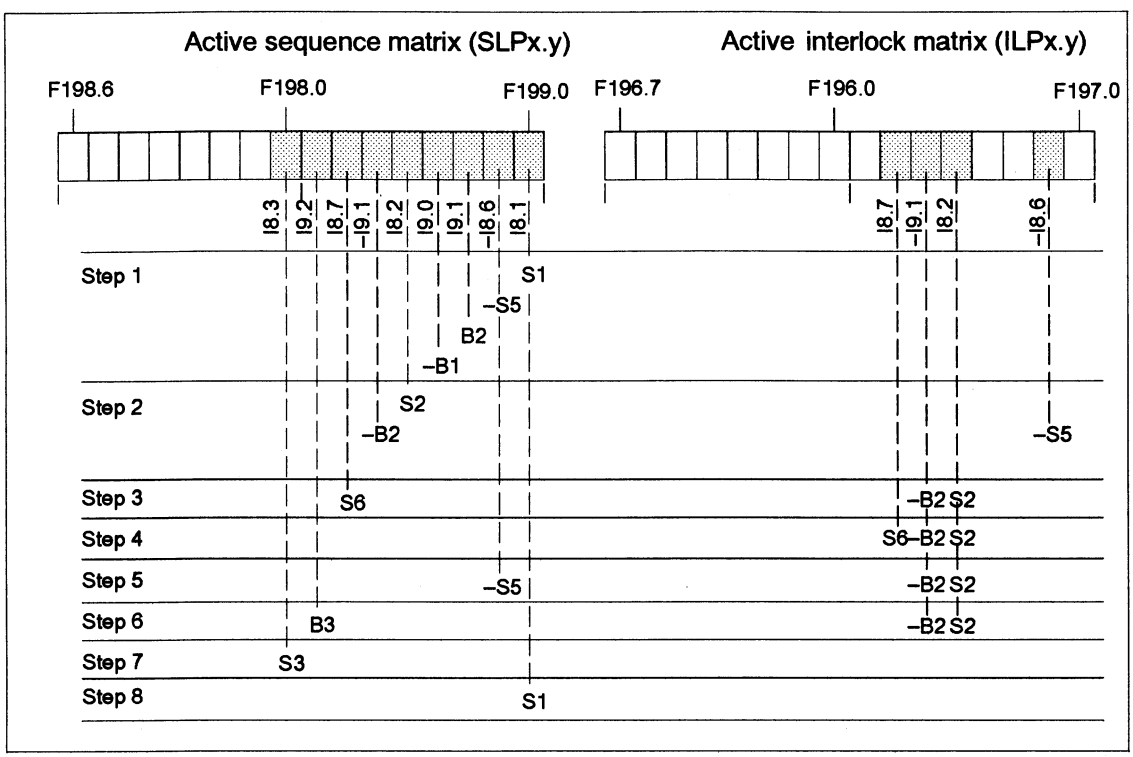
Edit Project Planning Form (continued)

Monitoring the embossing machine

Monitoring of the individual machine movements for disturbance-free sequence (via the end-position sensors) and the interlock of a movement, if unwanted sensors react in a certain cycle step, is illustrated once again graphically in the following diagram.

The shaded bit positions in the G5E matrices are set by the assigned inputs in the course of the processing steps. In the control system they are used as a step-enabling criterion or for a currently existing timeout and are deleted again at the end of the step.

Important: A bit in the SLP matrix must have the same signal as in the ILP matrix, e.g. I1.0 = SLP 1.5 -> ILP 1.5!



Filling out the project planning form

1. Select the function "Project planning form" in the step sequencer menu.

   GRAPH5-EDDI opens the blank form with 9 lines, each divided for entry of operands in absolute or symbolic notation. The current step sequencer number SB 60, is given on the upper right (magenta). ZULI (+) is marked below in the message line.

2. Enter the step number and then, line by line, enter the operands (symbolic or absolute) given in the column headers. Terminate each entry with <**Return**>.

Section 3.5

3. Once you have completed the bottom line of the form, scroll a new blank line into the screen, by placing the cursor on the last field on the far right and pressing <**Return**>.
4. The table "Overview of the automatic control functions" contains the most important specifications and instructions for making entries in your form. You must fill out a line for each action and for each machine state to be monitored (total of 15 here).
5. Enter the symbolic operands from the table directly in the G5E form. Scroll the form to the left and complete the entries by means of the relevant actuator flag (F50.0...F50.6) and the pushbutton operands for manual control of the machine movements.

   The pushbuttons are assigned to the following inputs (see ZULI):

Slide movement:	forwards pos. 2	= E1.0	(Step 2)
	forwards pos. 3	= E1.1	(Step 7)
	backwards	= E1.4	(Step 8)
Stamp movement:	downwards	= E1.2	(Step 3)
	upwards	= E1.3	(Step 5)

The fully edited project planning form for the machine process is depicted below in the same manner as it is output by the print log.

S-No.	Step comment										
	Abs/ Sym	Action/ Output	Reaction/ End pos.	SLP-D/ constant	ILP-S / constant	RSLP	Actuator flag	DT-action	DT-lamp	DT-co-mov.	Manual: ILP
1	Check basic position										
	ABS SYM	A 5.7 GRST	E 8.1 S1	F 199.0 ALP1.0			F 50.0 Y-GRST				
	ABS SYM		-E 8.6 -S5	F 199.1 ALP1.1							
	ABS SYM		E 9.1 B2	F 199.2 ALP1.2							
	ABS SYM		-E 9.0 -B1	F 199.3 ALP1.3							
2	Move slide forwards to pos. 2										
	ABS SYM	A 5.1 K2	E 8.2 S2	F 199.4 ALP1.4	F 197.0 VLP1.0		F 50.1 SCH.P.2	E 1.0 DTSV-P.2		E 1.4 DTSZGRST	-E 8.7 -S6
	ABS SYM		-E 9.1 -B2	F 199.5 ALP1.5	F 197.2 VLP1.2						
	ABS SYM				F 197.3 VLP1.3						
3	Lower stamp to embossing position										
	ABS SYM	A 5.0 K1	E 8.7 S6	F 199.6 ALP1.6	F 197.1 VLP1.1		F 50.2 S-AB	E 1.2 DTST-AB		E 1.3 DTST-AUF	-E8.3 -S3
4	Let embossing time expire										
	ABS SYM										

Continued

Edit Project Planning Form (continued)

S-No.	Step comment										
	Abs/ Sym	Action/ Output	Reaction/ End pos.	SLP-D/ constant	ILP-S / constant	RSLP	Actuator flag	DT-action	DT-lamp	DT-co-mov.	Ma-nual: ILP
5	Move stamp upwards										
	ABS SYM	A 5.0 K1	-E 8.6 -S5	F 199.1 SLP1.1	F 197.6 ILP1.6		F 50.3 S-AUF	E 1.3 DTST-AUF		E 1.2 DTST-AB	
6	Request: Empty container										
	ABS SYM	A 5.6 BEHLEER	E 9.2 B3	F 199.7 SLP1.7	F 197.1 ILP1.1		F 50.4 BEH.LEER				
7	Move slide forwards to pos. 3										
	ABS SYM	A 5.1 K2	E 8.3 S3	F 198.0 SLP1.8	F 197.7 ILP1.7		F 50.5 SCH.P.3	E 1.1 DTSV-P.3		E 1.4 DTSZGRST	-E 8.7 -S6
	ABS SYM				F 197.4 ILP1.4						
	ABS SYM				F 197.5 ILP1.5						
8	Move slide backwards to basic position										
	ABS SYM	A 5.2 K3	E 8.1 S1	F 199.0 SLP1.0	F 196.0 ILP1.8		F 50.6 SCH.GRST	E 1.4 DTSZGRST		E 1.1 DTSV-P.3	-E 8.7 -S6
998	ABS SYM		-E 8.7 -S6	F198.1 SLP1.9							
998	ABS SYM		-E 8.3 -S3	F198.2 SLP1.10							
	ABS SYM										

Generate blocks for step sequencer

1. Change to the function "Select" via key <**F4**>.
2. Select the function "Generate blocks" in the menu "Generate".

   If this generation run is not the first one, the system reports: "xxxxxxST.S5D already exists. Will be deleted !".
3. Confirm "Continue".

   Information the generation run is given in the message line. The numbers of the S5 blocks generated are automatically assigned acc. to the following principle:

   PB-MANUAL = PB 60
   PB-OUTPUT = PB160
   SB-FILTER = SB160

An extract of some of the segments of the three generated blocks is shown in the following section.

4.4 Extracts from the GRAPH5-EDDI Blocks

PB-OUTPUT

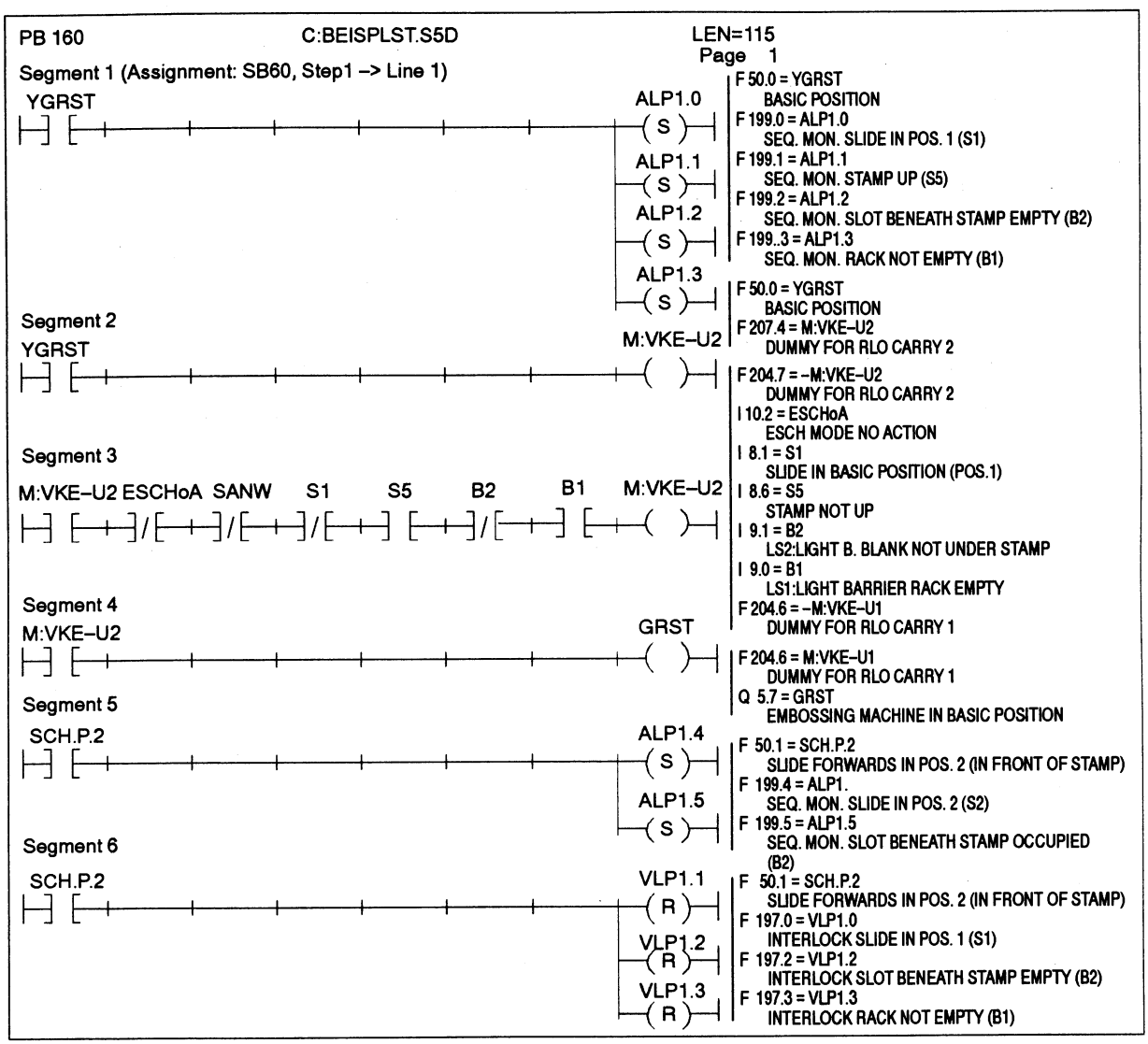
The diagram illustrates the programming of the first two steps of the sequential control system for the embossing machine in PB 160.

In segment 1, the bits which are relevant for the feedback signals of the machine state "Basic position" dependent on the actuator flag for the basic position indication are set in the S-matrix. A dummy (F204.7) is set in SEG2 for carry of the RLO.

In SEG3/4 the actuator flag formed (via F204.7) in the SB-sequencer is routed to the output. The "Basic position" = GRST is lit

if mode is not ESCH or SSEL ($-\overline{\text{ESCHoA}}$) or ($-\overline{\text{SANW}}$),
slide in basic position ($-\overline{\text{S1}}$),
stamp up ($-\overline{\text{S5}}$),
blank not under stamp ($-\overline{\text{B2}}$),
rack full ($-\overline{\text{B1}}$).

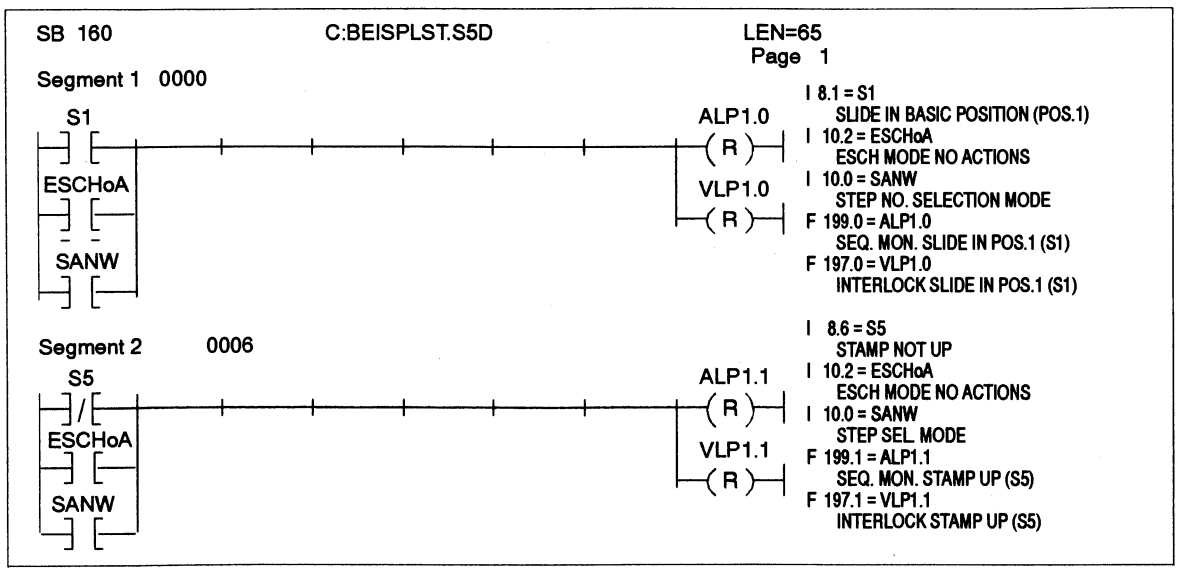
In SEG5 the bits relevant for the feedback signals of the slide movement in pos. 2 are set, dependent on the respective actuator flag.



In SEG6 the bits for monitoring the basic position (S1), the states "Rack full" (B1) and "Tool free" (B2), are deleted in the I-matrix, dependent on the flag for "Slide in pos. 2".

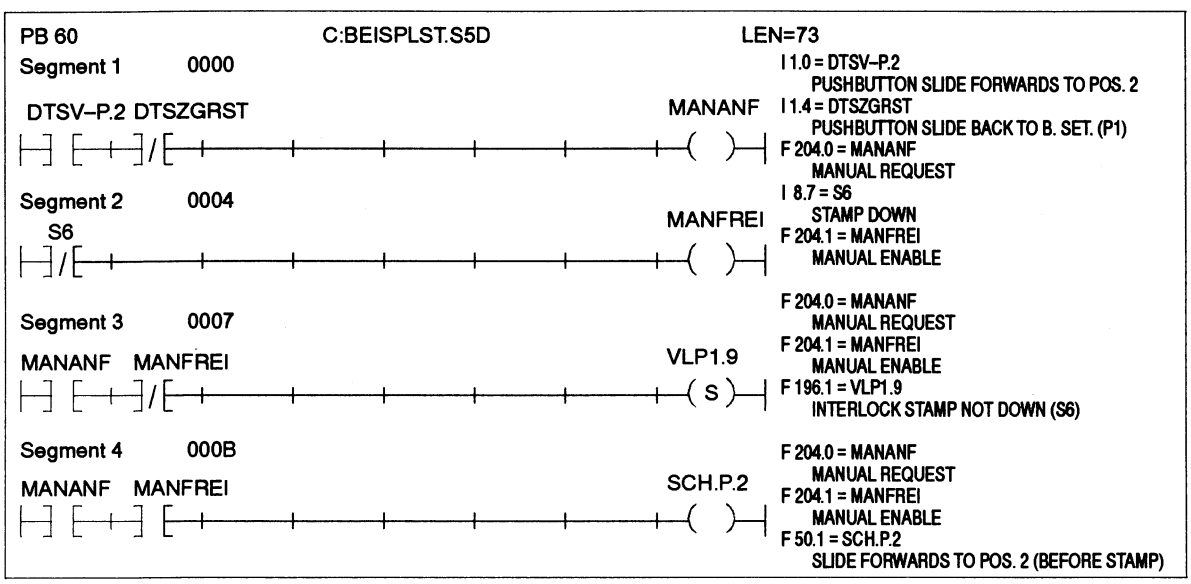
SB-FILTER

The bits associated with all system signals, which produce the 1-signal in the disturbance-free state, are deleted in the monitoring matrices.



PB-MANUAL

The request for the movement "Slide forwards to pos. 2" is programmed via the pushbutton in SEG1. The manual operation is interlocked in SEG2 by the state "Stamp down". The diagnosis for this is programmed via VLP1.6 in SEG3 and the actuator flag is assigned in SEG4.



Important for creating G5E programs

The various functions must be checked and adapted if necessary (GRST indication, same outputs repeatedly...). Similarly, data must be entered and removed from I/O parameters of the FB78 for each sequence. An example which runs on the S5-115U is given in file: "ANLAGEST.S5D". If you have a different PLC, you should also load the PLC-specific FB78 and SB8.

Technical Data for GRAPH5-EDDI

5

5.1 Characteristic Data and Standard Blocks of GRAPH5-EDDI

Characteristic data: GRAPH5-EDDI Ver 3.0

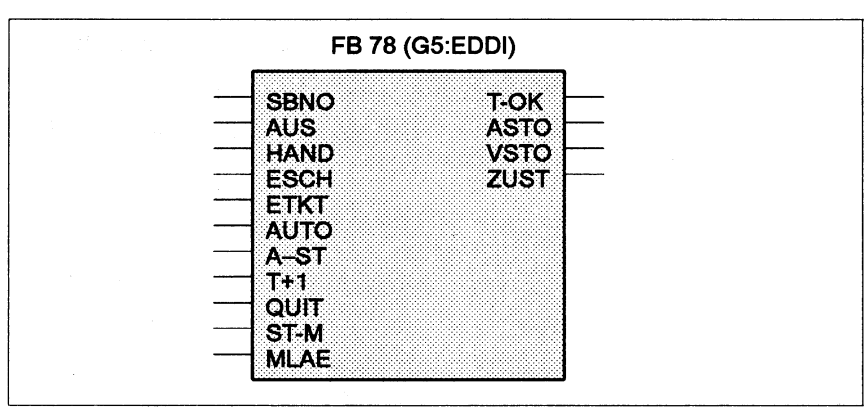
Number of sequencers:	max. 100
Structure of step sequencers:	linear sequencers with/without alternative branches
Step sequencers in a project file:	max. 16
Lines in the monitoring matrix:	min. 1/max. 25
Lines in the project planning form:	max. 50

The table shows the possible mode states of a G5E control as well as their priority (x = can only be activated separately).

Mode	Priority	Select via parameter on FB78 or data bit in the user DB (DW 139)
OFF (RESET)	1	AUS
MANUAL	2	HAND
STEP SEARCH	x	Bit 8 = "1"
SINGLE STEP no actions (ESCHoA)	x	ESCHoA with ESCH on flag, (ESCHoA) ESCH on FB78 with logical OR, or bit 9 = "1".
SINGLE STEP – with actions	x	ESCH
STEP SELECTION (SANW)	x	SANW with ETKT on flag, ETKT on FB78 with logical OR, or bit 10 = "1".
SINGLE PHASE	x	ETKT
GUIDED MANUAL OPERATION*	x	GEF. HANDB. with AUTO on flag, AUTO on FB78 with logical OR, or bit 7 = "1".
AUTOMATIC	x	AUTO

Technical data: FB78

FB78 has the following call block (input parameters on the left/output parameters on the right):



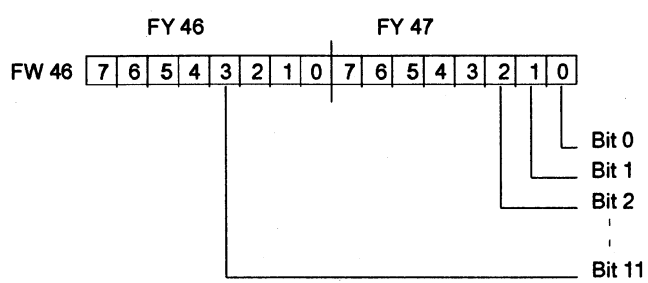
All of their functions can be activated via the user DB.

The following table contains explanatory descriptions of the eleven input parameters and the four output parameters of FB78.

Parameter name	Type	Name	Remarks
SBNO	KF	SB-Number	SB number of standard block to be processed
AUS	Bit	Sequencer "OFF" (Reset)	Evaluation as permanent signal; Effect: – All other modes are deselected, – The sequencer is set to step 0, – The actuator flags and the S/I matrix are deleted. Note: After OFF the mode set must be assumed again with A-ST.
HAND	Bit	Mode "Manual"	Evaluation as permanent signal. The mode "Manual" becomes active immediately after selection. Switch-over to MANUAL immediately terminates the current mode. The actuator flags are deleted, the active I-matrix can be selected.
ESCH	Bit	Mode "single step"	Evaluation as a permanent signal. The mode becomes active if there is an edge at A-ST; Effect: – Sequencer is enabled if transition is fulfilled and edge at T+1 (once monitoring time has expired), – The actuators are active, – Monitoring times are not active.
ETKT	Bit	Mode "Single phase"	Evaluation as a permanent signal. The mode becomes active if there is an edge at A-ST. Effect: – Sequencer is enabled, if transition is fulfilled, as in AUTO mode, – After processing once the sequencer stops at step x, – If there is an edge at A-ST, the sequencer begins running again, – Wait and monitoring times are active.
AUTO	Bit	Mode "Automatic"	Evaluation as a permanent signal. The mode becomes active if there is an edge at A-ST. Effect: – The sequencer is enabled if transition is fulfilled (S/I-matrix empty, TW expired), – Wait and monitoring times are active.
A-ST	Bit	Automatic Start	Evaluation with signal change from 0 to 1; Effect: – The set mode (AUTO, ESCH, ETKT) is assumed.
T+1	Bit	Tip signal for single step	Evaluation with signal change from 0 to 1, Effect: – With "ESCH", the sequencer is enabled by one step if transition is fulfilled. – With "ESCHoA", the sequencer is enabled immediately, by one step, without peripherals.
QUIT	Bit	Acknowledgment of a timeout	Evaluation with signal change from 0 to 1, Effect: – Having eliminated the cause of a timeout or an interlock error, the sequencer is enabled by acknowledging QUIT.
ST-M	KY	Actuator field	Evaluate bytewise: example KY 50, 18. The first number defines the first flag byte of the actuator field. The field in the example begins with FY50. It is 18 bytes long and thus ends with FY67. There are thus totally 18 x 8 = 144 flags defined.
MLAE	KF	Length of the matrices	Evaluation as a fixed-point number ($1 \preceq X \preceq 25$). MLAE defines the length of a matrix in lines (if different, the longest matrix).
T-OK	Bit	Transition fulfilled	Evaluation as a permanent signal. T-OK is relevant only in the ESCH mode. As soon as a step-enabling condition is fulfilled, T-OK is set to 1, thus displaying the readiness for switching to the next step.
ASTO	Bit	Sequence timeout	Evaluation as a permanent signal. If the sequencer cannot be enabled within the set monitoring time, ASTO is set to 1-signal.

Continued

Characteristic Data and Standard Blocks of GRAPH5-EDDI (continued)

Parameter name	Type	Name	Remarks
VSTO	Bit	Interlock error	Evaluation as a permanent signal. If a signal, which is monitored for interlock, changes its signal state during processing, VSTO is set to 1-signal.
ZUST	W	Status word	The individual bits of the word STAT are error codes or indications. Evaluation bit 0 ... 7 is only active for bits 8 ... 15 = 0. Bit 0: No SB-Sequencer/no SB8 Bit 1: SB-Sequencer not programmed in GRAPH5/II Bit 2: No user DB in sequencer Bit 3: User DB of sequencer : Length = 331 words Bit 4: No PB-MANUAL Bit 5: No PB-OUTPUT Bit 6: No SB-FILTER Bit 7: "MLAE" incorrectly parameterized Bit 8: OFF Bit 9: Actuate A-ST Bit 10: ETKT mode Bit 11: AUTO mode Bit 12: Acknowledge QUIT Bit 13: ESCH mode Bit 14: HAND mode Bit 15: Unoccupied Example for addressing: ZUST = FW 46 

All modes can also be activated internally via the user DB x (e.g. by a diagnostic unit such as CP 527, ...).
D 138.0 = 1 -> Internal selection via DW 139

- No input parameters except MLAE/ST-F/SB No. are active
- The output parameters continue being supplied with data.

Additional modes continue being available only via this parameter definition. The modes which are only possible internally can be operated in addition to the formal operands of FB78 also with D138.0 = "0".

Important: The editor function "DBGEN" may only be executed when the PLC is in the OFF mode.

Technical data: SB8

SB8 is a standard block without parameters which is merely loaded into the programmable controller. It is implemented as a standard sequence block.

SB8 is called by the SB-Sequencer (ID screen form: FB78). It causes the sequencer, whose number has been parameterized on the FB78, to stop or move to the next step. The SB8 receives the information it needs for processing the various step sequencers from the respective user DB or directly from the FB78.

Note: SB8 must only be loaded in the PLC and must not under any circumstances be called.

Technical data: user DB

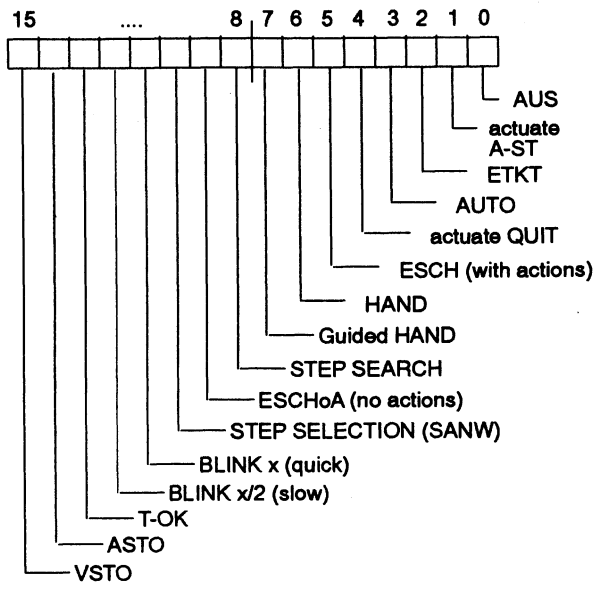
The following table contains an overview of the user data block assigned to each step sequencer.

Data word	For-mat	Meaning
20	KF	Current step number
43	KT	Planned TW time for step no. DW20
44	KF	Buffer with the highest error priority: line number
45	KM	Buffer with the highest error priority: bit pattern
51	KT	Planned TM time for step no. DW20
132	KM	K:AKT.B. Code for active block 0=SB-SEQUENCER 1=PB-MANUAL 2=PB-OUTPUT 3=SB-FILTER
133	KF	PB-MAN No. PB-MANUAL Default 0:Standard = X
134	KF	PB-OUTP No. PB-OUTPUT Default 0:Standard X+100
135	KF	SB-FILT No. SB-FILTER Default 0:Standard X+100
136	KF	TNR/PVLP Timer number bounce time ILP (KF):0= OFF
137	KF	TZ/PVLP Time value for bounce time ILP (KT):0= OFF
138	KF	Change mode selector: FB78/internal Bit 0: Select modes via DW139
139	KM	Mode sel. internal: active with D138.0= 1. Assign. as DW252
141	KY	System image parameter "ST-M"
142	KF	Step no. as stop point for ETKT mode
143	KF	Number of cycles for flashing frequency generation
144	KT	Bounce time for sequence error: 0=OFF
195	KF	Line number Interlock error with the highest priority
196	KM	Bit pattern Interlock error with the highest priority
197	KF	Line number Sequence error with the highest priority
198	KM	Bit pattern Sequence error with the highest priority
199	KF	Line number Output interf. err. with the highest priority
200	KM	Bit pattern Output interf. err. with the highest priority VSTO= 0: Sequence error VSTO= 1: Interlock error
		Sequence messages/errors
201	KM	1st line
225	KM	25th line
		Interlock errors
226	KM	1st line
250	KM	25th line

Continued

5

Characteristic Data and Standard Blocks of GRAPH5-EDDI (continued)

Data word	For-mat	Meaning
252	KM	Displays: 

5.2 Assignment of the GRAPH5-EDDI User DB

File C:S5DG50Z0.SEQ
(operands and symbols are in German; the comments in English as an explanation)

Operand	Symbol	Comment
		CURR. GRAPH5-EDDI STATUS: delivery middle 1993
		ASSIGNMENT DB <G5E: SEQUENCER> THE GAPS HAVE BEEN RESERVED FOR THE STANDARD AND MAY NOT BE USED BY THE USER.
		BASIS: GRAPH5 EDITOR V 6.X UNDER ST/MT (PULL-DOWN OPERATION)
DB 0	I:DB 0	FOR INDIRECT ADDRESSING: DO DW
M 101.0	VLP25.0	INTERLOCK AND MONITORING FLAGS (FW 100) " " " "
. . M 198.7	.. ALP1.15	" " " (FW 198)
		// AREA F204.0 – F206.7 RESERVED FOR SPECIAL USER APPLICATIONS (SB<FILTER> / PB<MANUAL> / PB <OUTPUT >) FLAG 206.6 INTERNALLY ASSIGNED //
M 204.0	MANANF	MANUAL REQUEST
M 204.1	MANFREI	MANUAL ENABLE
M 204.2	MANAUS	MANUAL SWITCH-OFF
M 204.6	M:VKE-U1	DUMMY FOR RLO CARRY 1
M 204.7	M:VKE-U2	DUMMY FOR RLO CARRY 2
M 205.6	HANDFREI	MANUAL OPERATION ENABLE
M 205.7	BLINKX	FLASHING FREQUENCY X HZ (QUICK)
M 206.0	BLINKX/2	FLASHING FREQUENCY X/2 HZ (SLOW)
		// AREA F207.0 – F207.7 IS FREE FOR THE USER! //
M 233.0	AUTOFREI	AUTOMATIC OPERATION ENABLE
MW 222	=DW252	DISPLAY WORD INTERNAL
		!!!!!!!!!!!!!!!! IMPORTANT !!!!!!!!!!!!!!!!!!!! THE USER MAY READ ALL DATA WORDS BUT ONLY WRITE THE DATA WORDS DW80-131/132-139/142-144. !!
DW 0	SBNR/SM.	DL0:SB NO. / DR0:MAX. S-NO.
DL 2	D:EB0-ST	DISTURBED STEP NUMBER AT LEVEL 0
DL 7	D:N-SBNR	SPECIFY NEXT SB NO. IN LIST DBGEN
DW 8	PGSW-VER	GRAPH5-EDITOR SW VERSION 1993: KY = 4.0
DW 9	AGSW-VER	PLC SOFTWARE VERSION 1993: KY = 4.0

Continued

Assignment of the GRAPH5–EDDI User DB (continued)

Operand	Symbol	Comment
DW 10	N.-SNR.	NEXT STEP POSSIBLE (ENTRY FROM TX + ONLY 1 CYCLE OF DW20 DIFFERENT WHILE SWITCHING TO THE NEXT STEP)
DL 18	D:ANZ-SR	DL: MAX. PROGR. STEPS IN 16 GROUPS (CODED NUMBER: 1 =>S<=16:BIT 0=1 16 =>S<=16:BIT 0=1 etc.
DR 18	D:ANZ-EB	DR: PROGRAMMED LEVELS (CODED NUMBER: 1:BIT 0 = 1 2:BIT 0+1=1 ETC.)
DW 18	SCHRITTE	DL:MAX STEP NUMBER DR:PROG. LEVELS (KY)
DW 20	AKT.SNR.	DISPLAY CURRENT STEP NO. (KF)
DW 42	TWA-NR.	DISPLAY CURRENT TW NUMBER (KF)
DW 43	TWA-ZEIT	PLANNED TW TIME (KT) FOR S–NO. DW 20
DW 44	P:Z-Nr.	BUFFER ERROR HIGHEST PRIORITY: LINE NUMBER
DW 45	P:BITM.	BUFFER ERROR HIGHEST PRIORITY: BIT PATTERN
DW 50	TUE-NR	DISPLAY CURRENT TM NUMBER
DW 51	TUE-ZEIT	PLANNED TM TIME (KT) FOR S-NO. DW 20
DW 58	INIT-S	INIT STEP: KY BIT, BYTE ADDRESS TO SIMPLIFY MATTERS, THE USER HAS THE "F233.0" AS A SPACE HOLDER FOR THE INTERNAL AUTOMATICALLY ASSIGNED STEP FLAGS (AUTOFREE FLAGS). EACH STEP HAS 1 INTERNAL STEP FLAG S 0 => F234.0 S 1 => F234.1 ..... S 127 => F 249.7 THE STEP FLAGS ARE SAVED ACC. TO THE PRINCIPLE L FW234 => T DW66...
DW 66	R 00-15	SAVED STEP FLAGS S 0-15
DW 67	R 16-31	SAVED STEP FLAGS S 16-31
DW 68	R 32-47	SAVED STEP FLAGS S 32-47
DW 69	R 48-63	SAVED STEP FLAGS S 48-63
DW 70	R 64-79	SAVED STEP FLAGS S 64-79
DW 71	R 80-95	SAVED STEP FLAGS S 80-95
DW 72	R 96-111	SAVED STEP FLAGS S 96-111
DW 73	R112-127	SAVED STEP FLAGS S 112-127
		//////////////////////////// DW 80-98 FREE FOR USER ////////////////////////////
		DW 99-131 ARE ONLY NEEDED IN CONJUNCTION WITH THE O&M FUNCTION:DT/DTL DIRECT ACTIVATION VIA INTERNAL DATA INTERFACE (OP30)
DW 99	M:DT/DTL	PARAMETERS FLAG FIELD PUSHBUTTON/DT LAMP KY = <1.F–BYTE>, <LAST F–BYTE> --- THE NUMBER OF FLAG BYTES IS PERMITTED ONLY IN 4 FY STEPS ACC. TO THE FOLLOWING FORMULA: FY END = FY START+ (NX4) – 1 N: NUMBER OF DT LEVELS UNASSIGNED LEVELS REMAIN FREE

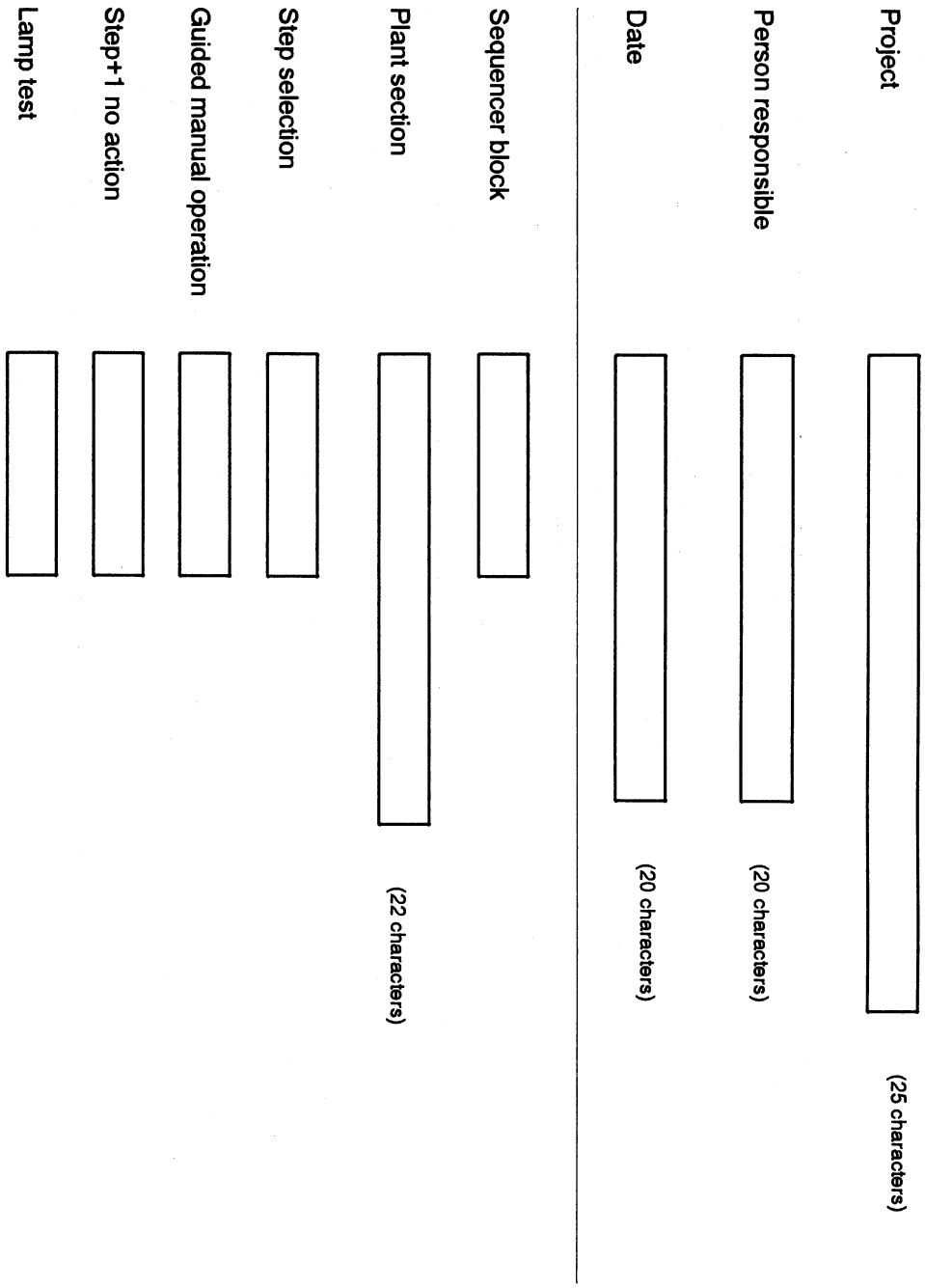
Operand	Symbol	Comment
		UNASSIGNED DT WITHIN A LEVEL S ARE PERMANENTLY ASSIGNED + RESERVED ALLOT: 1ST HALF FLAG => DT 2ND HALF FLAG => DTL DW 100–131 ASSIGNED TO 16X16 DT + DT–L ASSIGNMENT:BIT 0 => F 1 ..... BIT 15 => F 16 PER LEVEL (DW)! KY=0.0 FUNCTION NOT ACTIVE +DW110–DW131 FREE FOR OWN APPLICATIONS!
DW 100	DT/E1	MANUAL: PUSHBUTTON ACTION LEVEL 1
		.....
DW 115	DT/E16	MANUAL: PUSHBUTTON ACTION LEVEL 16
DW 116	DTL/E1	MANUAL: PUSHBUTTON LAMPS ACTION LEVEL 1
DW 131	DTL/E16	MANUAL: PUSHBUTTON LAMPS ACTION LEVEL 16
DW 132	K:Akt.B.	Code: ACTIVE BLOCK 0 = S-SEQUENCER 1 = PB-MANUAL 2 = PB-OUTPUT 3 = SB-FILTER ///// NO. SB-SEQUENCER DIRECTLY ON FB78! /////
DW 133	PB-HAND	NO. PB-MANUAL DEFAULT 0: STANDARD=X
DW 134	PB-AUSG	NO. PB-OUTPUT DEFAULT 0: STANDARD=X+100
DW 135	SB-FILT	NO. SB-FILTER DEFAULT 0: STANDARD=X+100
DW 136	TNR/PVLP	TIMER NUMBER BOUNCE TIME ILP (KF) :0=OFF
DW 137	TZ/PVLP	TIME VALUE FOR BOUNCE TIME ILP (KT) :0=OFF
DW 138	BA-SOND.	SWITCH MODE SELECT FB78/INTERNAL BIT 0: SELECT MODES VIA DW139 BIT 1: MANUAL: ONLY ILP MANUAL VALID BIT 3: BUFFER ERROR HIGHEST PRIORITY ENABLED FOR NEXT ENTRY (SAME FCT. CAN ALSO BE IMPLEMENTED BY DELETING DW44 + DW45) BIT 4: PREVENT ILP ENTRY/CANCELLATION
DW 139	BA-INTER	INT. MODE SELECT: ACTIVE AT D138.0 = 1! ASSIGNMENT AS DW252, BUT: BIT 1: A-ST BIT 4: QIT BIT 11+12:RESERVE! BIT 13: T+1 BIT 14+15:RESERVE!
DW 141	P:ST-M	SYSTEM IMAGE PARAMETER "ST-M"
DW 142	M-ETKT	STEP NUMBER FOR STOP PT. WITH "ETKT"
DW 143	Z-BLINK	SELECT CYCLES FOR FLASHING FREQ.
DW 144	TZ/PALP	TIME VALUE FOR BOUNCE TIME SLP (KT): 0 = OFF
		// DATA FIELD FOR SETTING UP ACTIVE ILP MONITORING (DW145 – DW194) //
DW 145	VLP25-M	DISPLAY ILP 25 ACTIVE
DW 146	VLP25-N	SETUP ILP 25 NEXT STEP ACTIVE
DW 147	VLP24-M	DISPLAY ILP 24 ACTIVE
DW 148	VLP24-N	SETUP ILP 24 NEXT STEP ACTIVE
.. ...	.....-.	.....
DW 191	VLP01-M	DISPLAY ILP 2 ACTIVE
DW 192	VLP01-N	SETUP ILP 2 NEXT STEP ACTIVE
DW 193	VLP01-M	DISPLAY ILP 1 ACTIVE
DW 194	VLP01-N	SETUP ILP 1 NEXT STEP ACTIVE

Continued

Assignment of the GRAPH5-EDDI User DB (continued)

Operand	Symbol	Comment
		//
		DATA FIELD FOR EVALUATION OF THE ERRORS WITH THE HIGHEST PRIORITY (DW199 – 200)
		//
DW 195	ZNR.-VF	LINE NUMBER I-ERROR WITH THE HIGHEST PRIORITY
DW 196	BITM-VF	BIT PATTERN I-ERROR WITH THE HIGHEST PRIORITY
DW 197	ZNR.-AF	LINE NUMBER S-ERROR WITH THE HIGHEST PRIORITY
DW 198	BITM-AF	BIT PATTERN S-ERROR WITH THE HIGHEST PRIORITY
DW 199	ZNR.-F	LINE NUMBER ERROR WITH THE HIGHEST PRIORITY
DW 200	BITM-F	BIT PATTERN ERROR WITH THE HIGHEST PRIORITY
		//
		DATA FIELD FOR EVALUATION OF THE INDIVIDUAL SEQUENCE MESSAGES (DW201 – DW225)
		//
DW 201	D:ALP01	DATA SEGMENT FOR SLP 01
DW 202	D:ALP02	DATA SEGMENT FOR SLP 02
.. ...	.....–.	.....
DW 224	D:ALP24	DATA SEGMENT FOR SLP 24
DW 225	D:ALP25	DATA SEGMENT FOR SLP 25
DW 226	D:VLP 1	DATA SEGMENT FOR ILP 1
		//
		DATA FIELD FOR EVALUATION OF THE INDIVIDUAL INTERLOCK ERRORS (DW226 – DW250)
		//
DW 227	D:VLP 2	DATA SEGMENT FOR ILP 2
.. ...	.....–.	.....
DW 249	D:VLP24	DATA SEGMENT FOR ILP 24
DW 250	D:VLP25	DATA SEGMENT FOR ILP 25
DW 251	IMP/SOND	DR251:DISPLAY OF THE PULSES (1 PLC CYCLE) DR251:DISPLAY SPECIAL FUNCTIONS BIT 0: STEP 0 ACTIVE = F254.0 INTERNAL BIT 1: "T+1" = F254.1 " BIT 2: "A-ST" = F254.2 " BIT 3: "QIT" = F254.3 " BIT 8: INCOMPATIBLE WITH GRAPH5-EDITOR (GRAPH5-EDITOR MUST BE V6.0) BIT 9: STEP SEARCH: MIN. 1 STEP FOUND
DW 252	BA-ANZ	DISPLAY OF ACTIVE MODES BIT 0: "OFF" BIT 1: ACTUATE "A-ST" BIT 2: "ETKT" BIT 3: "AUTO" BIT 4: ACTUATE "QIT" BIT 5: "ESCH" (WITH ACTIONS) BIT 6: "MANUAL" BIT 7: GUID. MAN. (ACTIV. AUTO WITH DTL) BIT 8: STEP SEARCH BIT 9: "ESCHoA" (NO ACTIONS) BIT 10: STEP SELECTION (SSEL) BIT 11: FLASH X HZ (QUICK) BIT 12: FLASH X/2 HZ (SLOW) BIT 13: "T-OK" BIT 14: "ASTO" BIT 15: "VSTO" DW252 = FW 222 INTERNAL

5.3 Project Planning Form for GRAPH5-EDDI



PROJECT PLANNING FORM GRAPH5-EDDI

Step comment step [ ] : [ ]

Step No.	Action/ Output	Reaction/ End pos.	SLP–D/ constant	ILP–S/ constant	RSLP	Actuator flag	DT– action	DT– lamp	DT– co–mov.	Manual: ILP	Manual: ILP	Manual: ILP	Manual: ILP

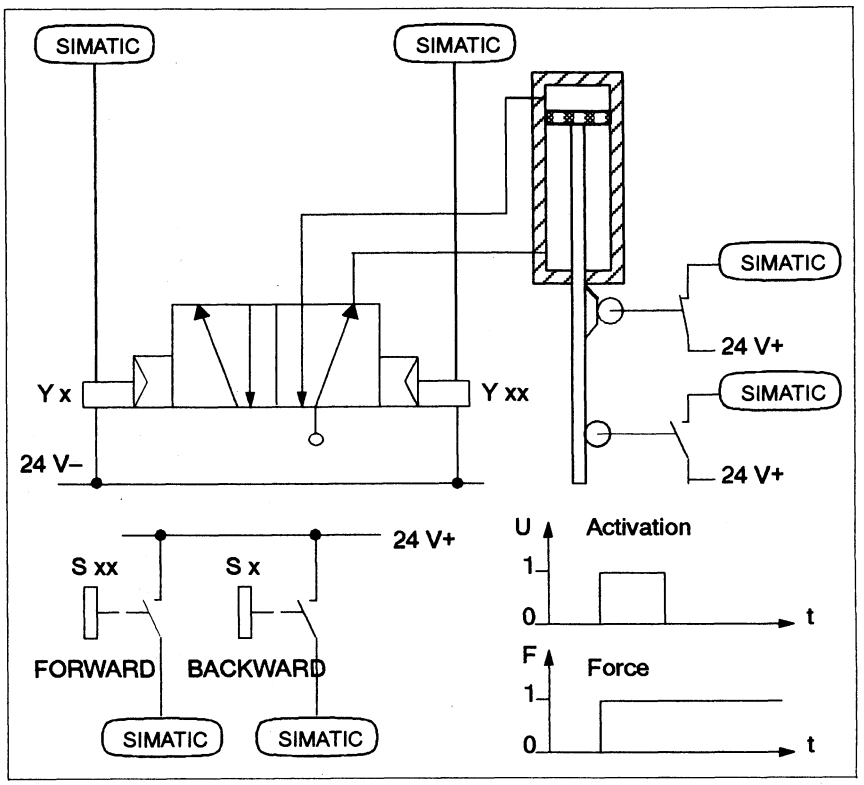
5.4 Programmierung spezieller Stellglieder

Macros for special actuators

Project planning of the described actuators is available with the basic GRAPH5-EDDI delivery as a macro under the following names:
Macro file: STELLGMC.DBF; pulse valve: IMPULS; signal valve: SIGNAL; center-position valve: MITTEL; Motor drive: MOTOR.
Integrate the manual interlocks in the column "End position". The mode-related lines are generated after selecting the respective mode.

Pulse valve

The pulse valve is a control device with two control inputs. The valve's working and resting movements are triggered by setting two different control outputs. The valve maintains itself in the last position activated.



Pulse valve: blocks

The graphics illustrate the G5E blocks of the pulse valve in LAD depiction, where the symbolic operands have the following meaning:

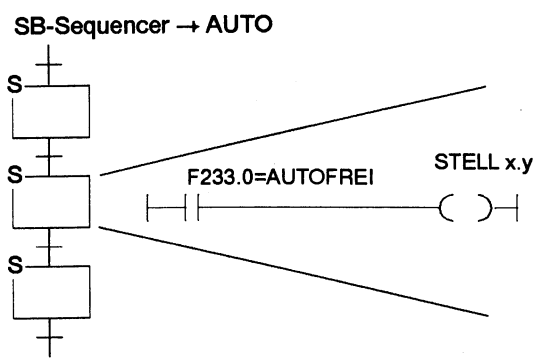
DT-VOR/DT-RCK	Pushbutton for forward/backward movement
STELLx.y/STELLx.z	Actuator flag for forward/backward movement
a/c	Interlocks which must be fulfilled for the manual activation of the forward/backward movement
Y-VOR/Y-RCK	Output "Pulse valve forwards/backwards"
ME-VOR/ME-RCK	Limit switch for position "AT FRONT/AT REAR"
DTL-VOR/DTL-RCK	Lamp in pushbutton forward/backward movement
ALPn.y/ALPn.z	Sequence monitoring lamp forward/backw. movement
VLPn.y/VLPn.z	Interlock monitoring lamp forward/backw. movement

Continued

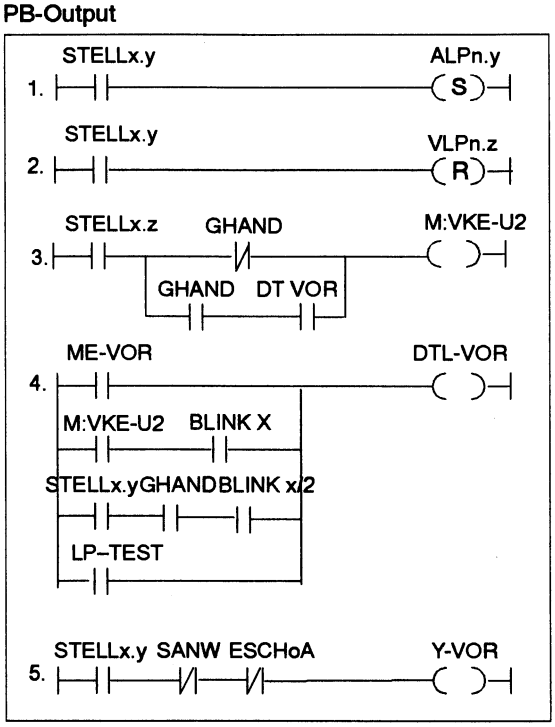
Programming Special Actuators (continued)

HAND	F205.6: Mode "MANUAL" of FB78
LP-TEST	Test lamps
BLINK X	F205.7: flashing frequency (x Hz) of FB78
BLINK X/2	F206.0: flashing frequency (X/2 Hz) of FB78
GHAND	Guided manual operation
SANW	Step selection
ESCHoA	Single step (no actions)
M:VKE-U2	Auxiliary flag RLO carry 2

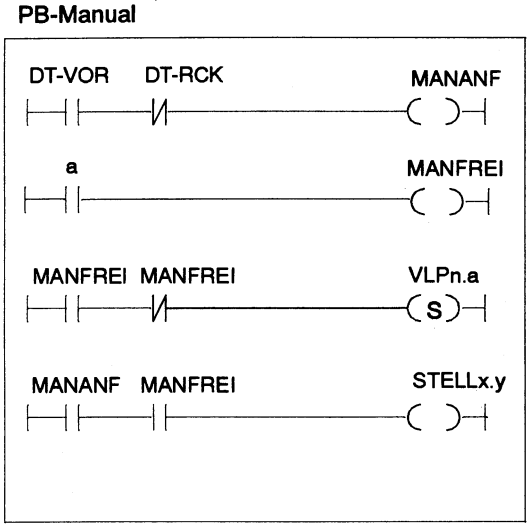
Pulse valve
Working movement: FORWARD



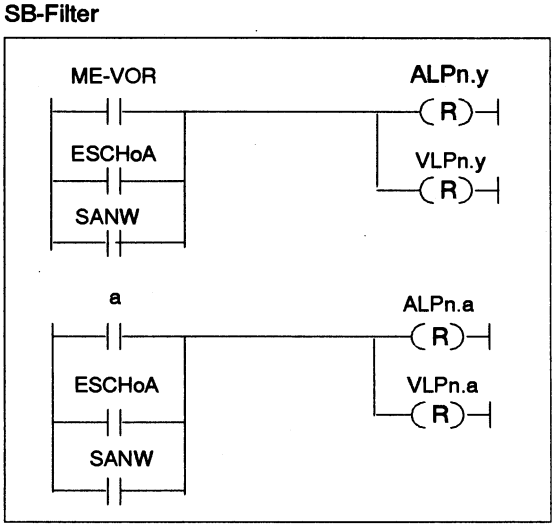
PB-Output



PB-Manual

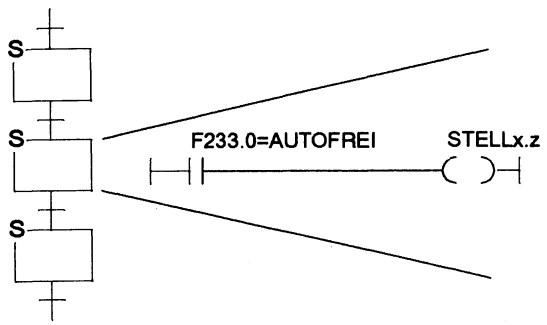


SB-Filter

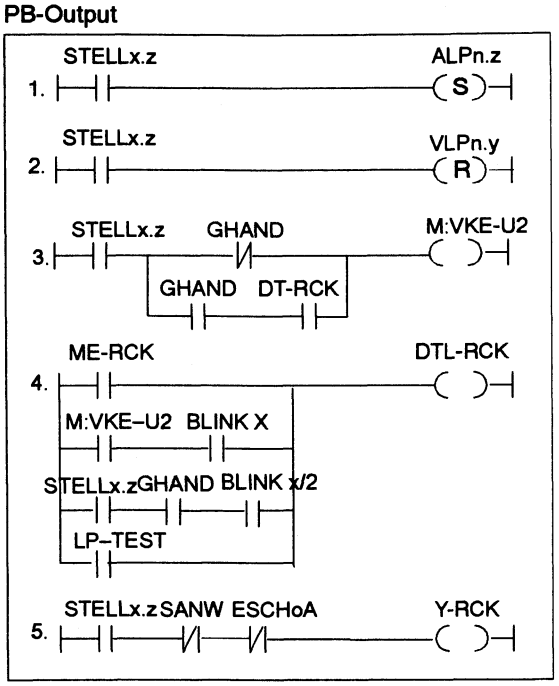


Pulse valve
Working movement: BACKWARD

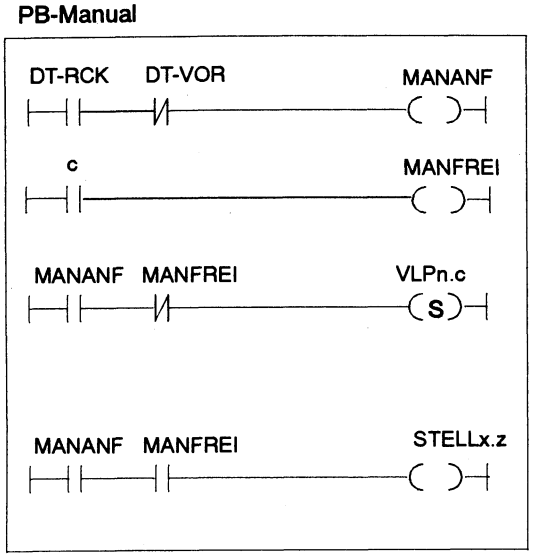
SB-Sequencer → AUTO



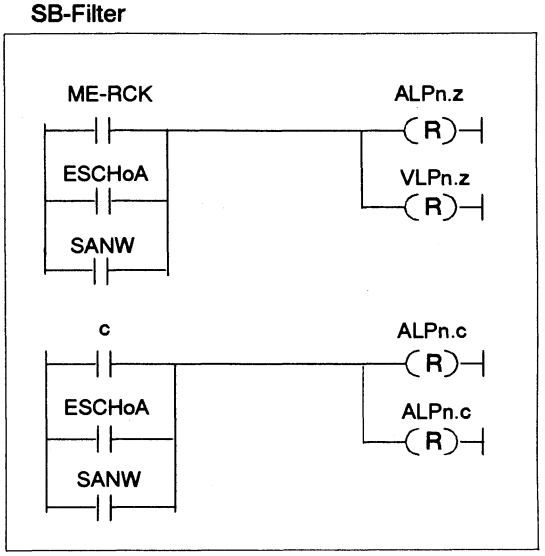
PB-Output



PB-Manual



SB-Filter



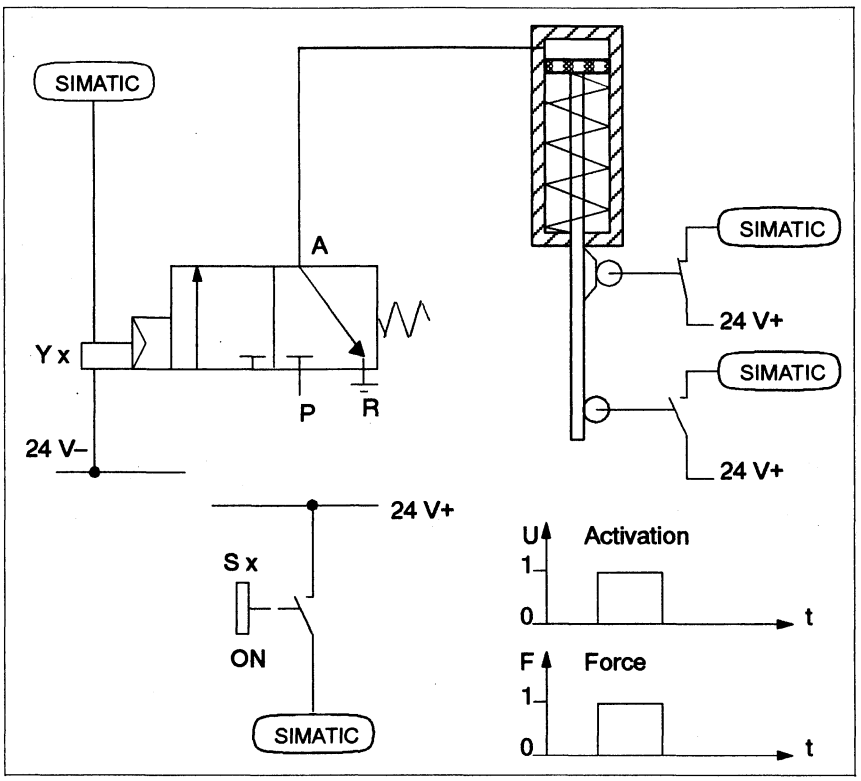
Continued

5

Programming Special Actuators (continued)

Signal valve

The signal valve is a positioning device with only one control input. Hence, the same output address must be given for working and return movement. The valve only remains in the working position as long as the output is activated. In the guided modes, an actuator flag is set in the SB-Sequencer, and is routed to the output in the PB-Output. The signal valve is actuated via a self-latching mechanism in the manual mode. The working movement is not monitored for interlock as a standard measure.



Signal valve: blocks

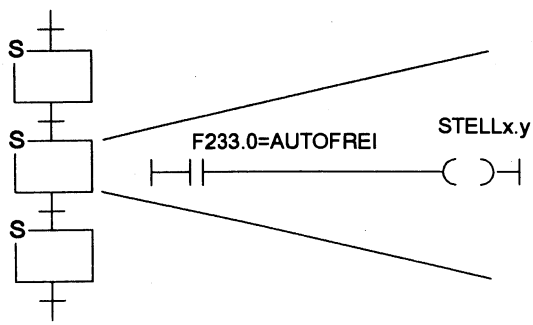
The nearby graphics show the G5E blocks of the signal valve in LAD representation, where the symbol operands have the following meaning:

DTL-VOR/DTL-RCK	Pushbutton for forward/backward movement
STELLx.y	Actuator flag for forward/backward movement
a/c	Interlocks which must be fulfilled for the manual activation of the forward/backward movement
Y-VOR	Output "Signal valve forwards"
ME-VOR/ME-RCK	Limit switch for position "AT FRONT/AT REAR"
DTL-VOR/DTL-RCK	Lamp in pushbutton forward/backward movement
ALPn.y/ALPn.z	Sequence monitoring lamp forward/backw. movement.
VLPn.y/VLPn.z	Interlock monitoring lamp forward/backw. movement.
HAND	F205.6: Mode "Manual" of FB
LP-TEST	Test lamps
BLINK X	F205.7: flashing frequency (x Hz) of FB78
BLINK X/2	F206.0: flashing frequency (X/2 Hz) of FB78
GHAND	Guided manual operation

SANW	Step selection
ESCHoA	Single step (no actions)
M:VKE-U2	Auxiliary flag RLO carry 2

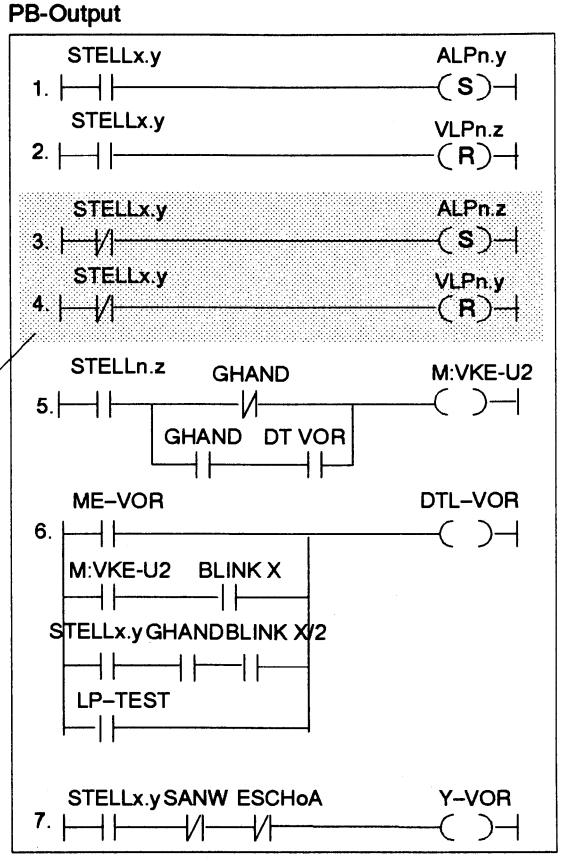
Signal valve
Working movement: FORWARD

SB-Sequencer → AUTO

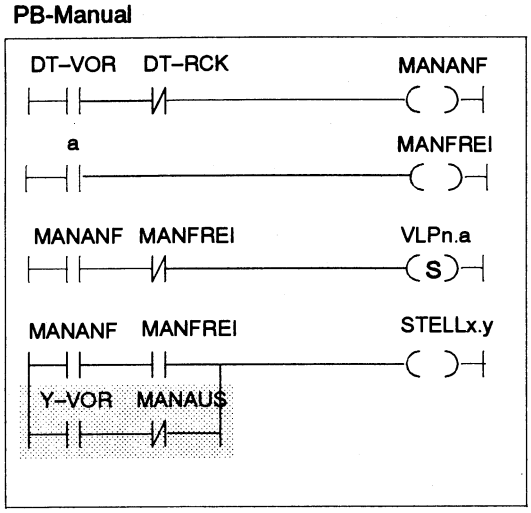


To be entered, if necessary, by the user

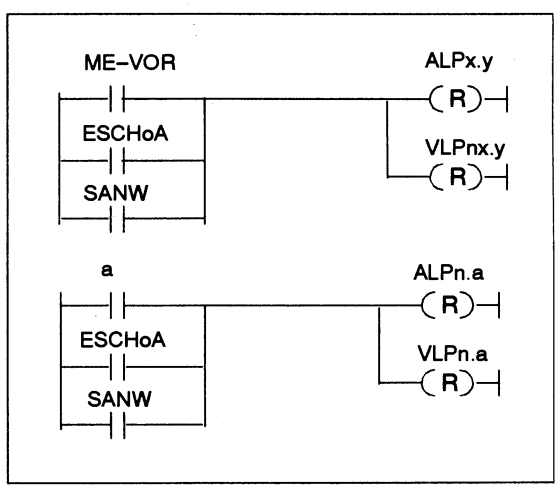
PB-Output



PB-Manual



SB-Filter



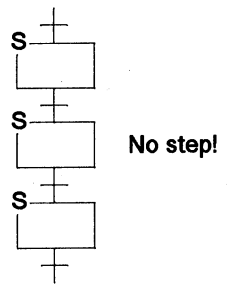
5

Continued

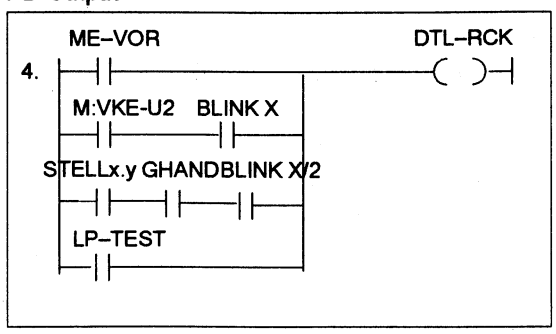
Programming Special Actuators (continued)

Signal valve
Return movement

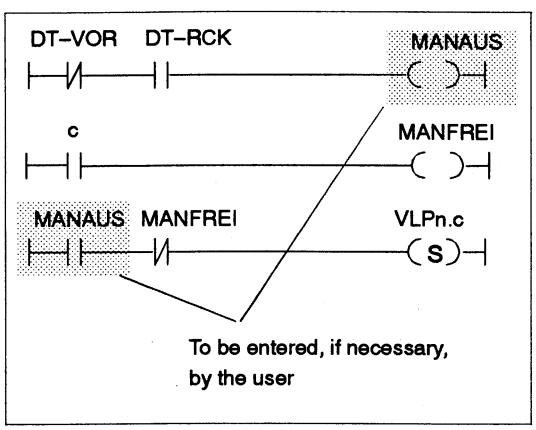
SB-sequencer → AUTO



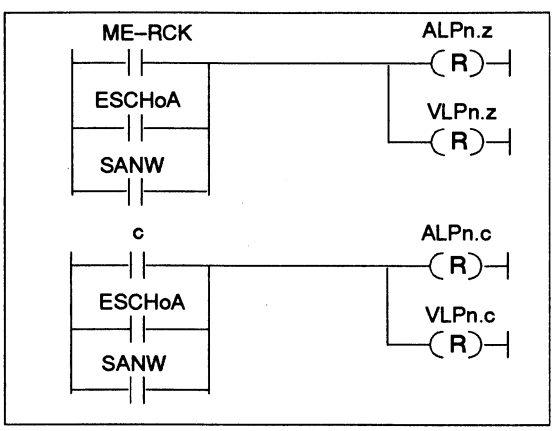
PB-Output



PB-Manual

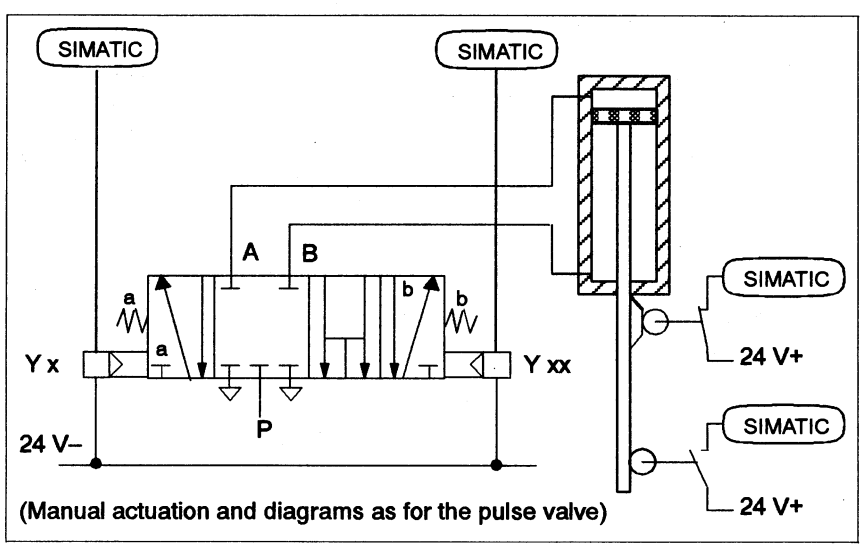


SB-Filter



Center position valve

The center-position valve is a positioning device with two control inputs. Unlike the pulse valve, however, the center-position valve output must remain activated in order to keep the valve pressurized. This is accomplished by a self-latching contact which is activated on reaching the end position. The self-latching contact is de-energized if the return movement is activated or an interlock error occurs.



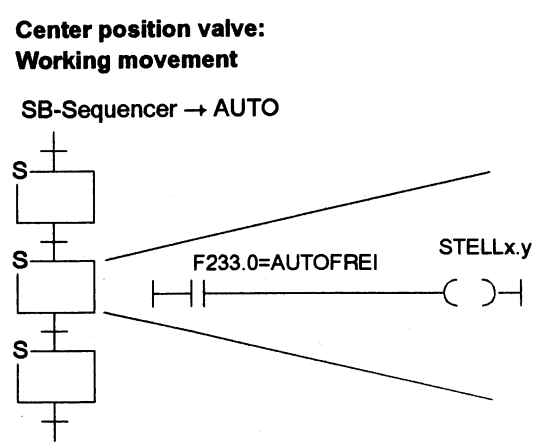
(Manual actuation and diagrams as for the pulse valve)

Center-position valve blocks

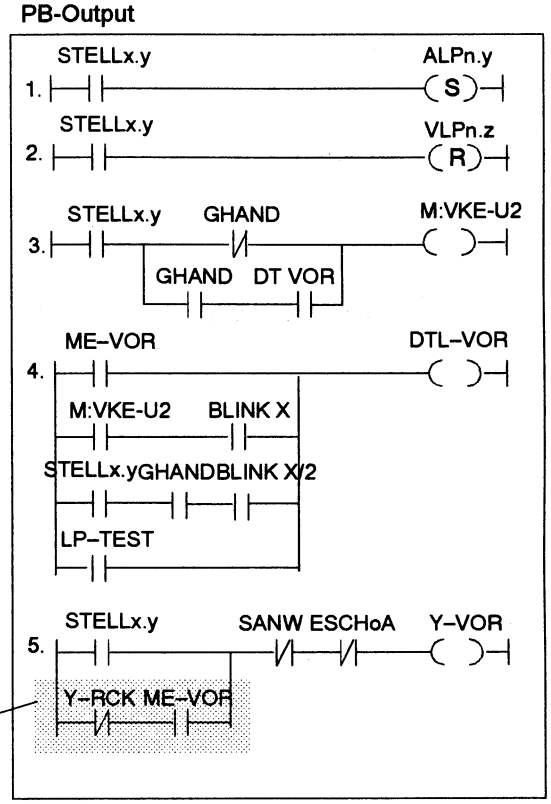
The nearby graphics show the G5E blocks of the center-position valve in LAD representation, where the symbol operands have the following meaning:

DT-VOR/DT-RCK	Pushbutton for forward/return movement
STELLx.y/STELLx.z	Actuator flags for forward/return movement
a/c	Interlocks which must be fulfilled for the manual activation of the forward and return movement
Y-VOR/Y-RCK	Output "Signal valve forward/return"
ME-VOR/ME-RCK	Limit switch for position "AT FRONT/AT REAR"
DTL-VOR/DTL-RCK	Lamp in pushbutton forward/return movement
ALPn.y/ALPn.z	Sequence monitoring lamp forward/return movement
VLPn.y/VLPn.z	Interlock monitoring lamp forward/return movement
HAND	F205.6: Mode "Manual" of FB78
LP-TEST	Test lamps
BLINK X	F205.7: flashing frequency (x Hz) of FB78
BLINK X/2	F206.0: flashing frequency (X/2 Hz) of FB78
GHAND	Guided manual operation
SANW	Step selection
ESCHoA	Single step (no actions)
M:VKE-U2	Auxiliary flag RLO carry 2

Center position valve: Working movement



PB-Output

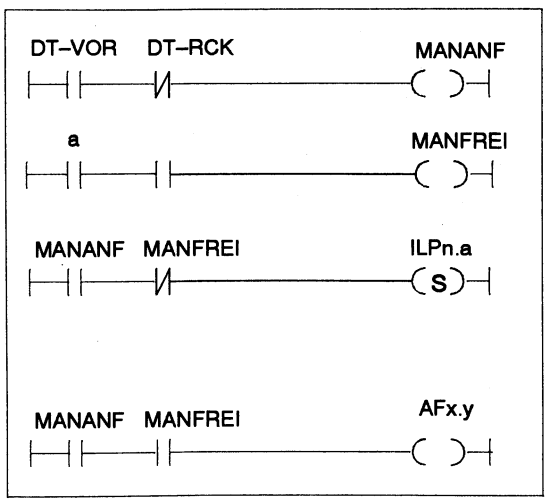


To be entered, if necessary, by the user

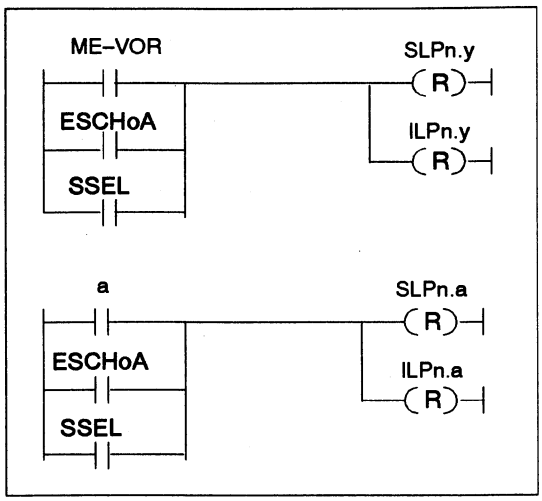
Continued

Programming Special Actuators (continued)

PB-Manual

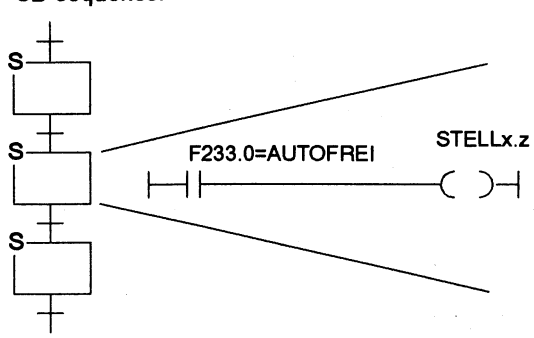


SB-Filter

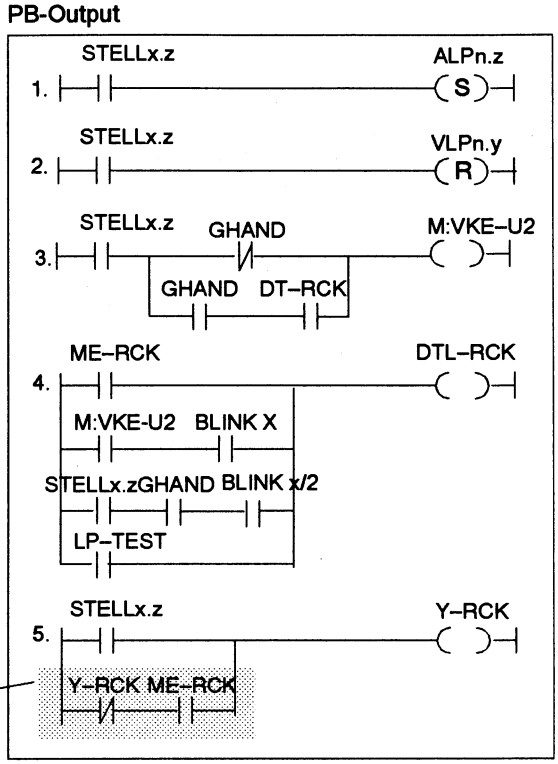


Center position valve
Return movement

SB-sequencer → AUTO

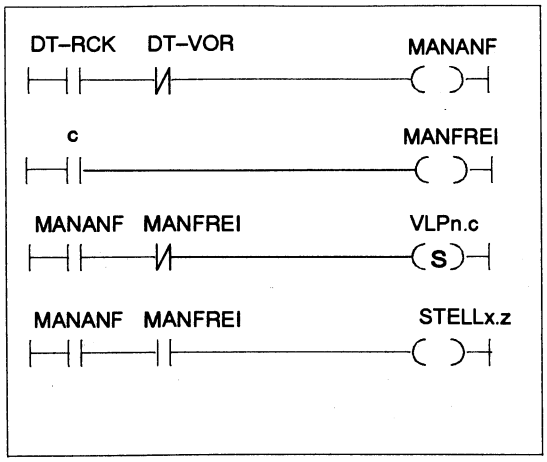


PB-Output

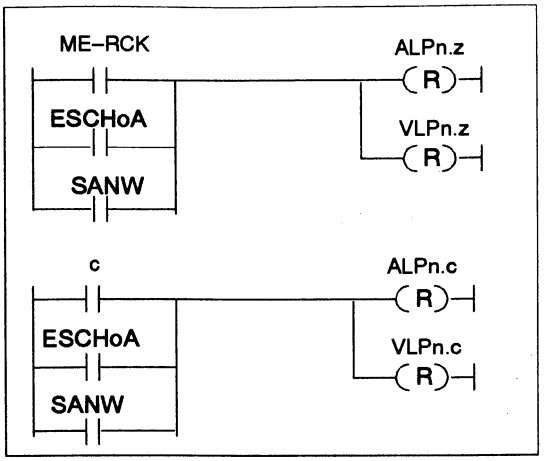


To be entered, if necessary, by the user

PB-Manual



SB-Filter



Motor drive

Programming of a motor control system is similar to that of a pulse valve. The drive is switched off only on reaching the corresponding end position, while a step is needed for each direction of movement (forward and backward) in the sequencer, featuring the corresponding program lines in PB-MANUAL, PB-OUTPUT and SB-FILTER.

Motor drive: blocks

The following graphics show the standard default settings for the program part of a simple drive, where the symbolic operands have the following meaning:

DT-VOR/DT-RCK	Pushbutton for forward/backward movement
STELLx.y/STELLx.z	Actuator flags for forward/backward movement
a/c	Interlocks which must be fulfilled for the manual activation of the forward/backward movement
MV-MT/MR-MT	Output "Motor forwards/backward"
ME-MTVOR/ME-MTRCK	Limit switch for position "AT FRONT/AT REAR"
DTL-MTVOR/DTL-MTRCK	Lamp in pushbutton forward/backward movement
ALPn.y/ALPn.z	Sequence monitoring lamp forward/backward movement
VLPn.y/VLPn.z	Interlock monitoring bit forward/backw. movement
HAND	F205.6: mode "Manual" of FB78
LP-TEST	Test lamps
BLINK X	F205.7: flashing frequency (x Hz) of FB78
BLINK X/2	F206.0: flashing frequency (X/2 Hz) of FB78
GHAND	Guided manual operation
SANW	Step selection
ESCHoA	Single step (no actions)
M:VKE-U2	Auxiliary flag RLO carry 2

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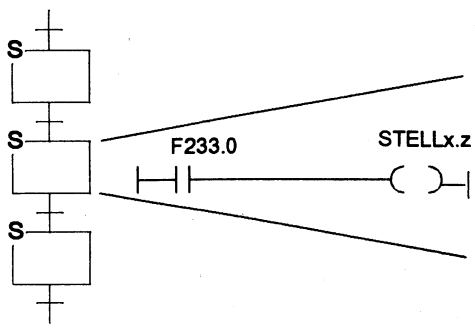
Continuation

Programming Special Actuators (continued)

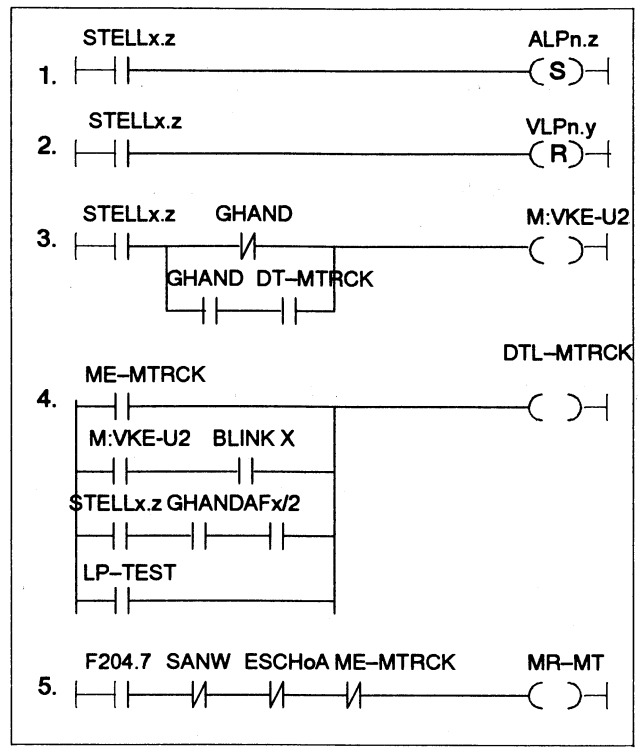
Return movement

SB-sequencer → AUTO

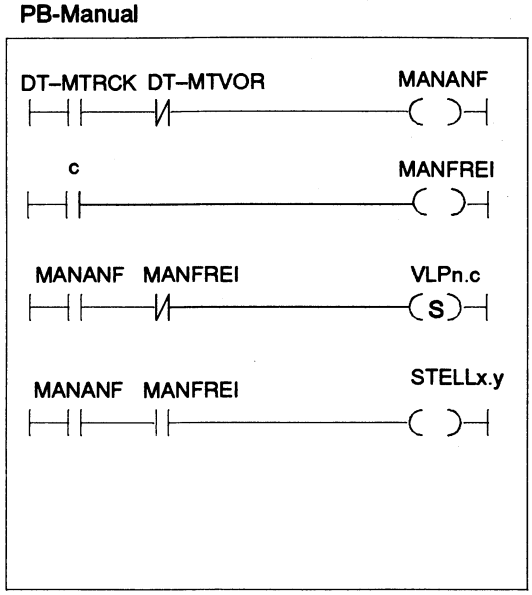
Movement: RETURN



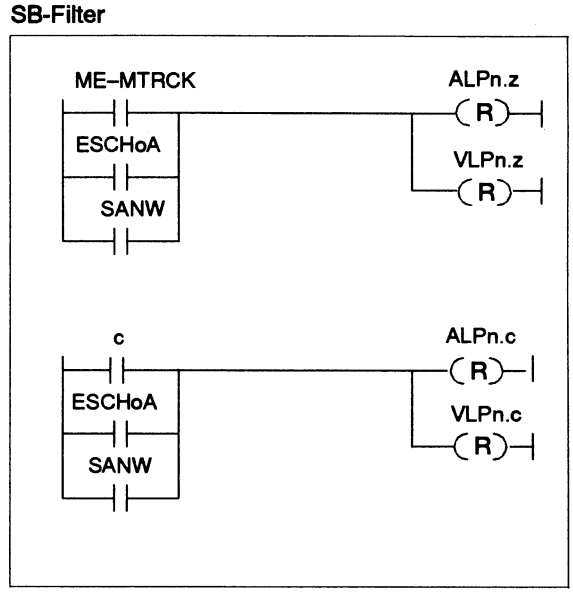
PB-Output



PB-Manual



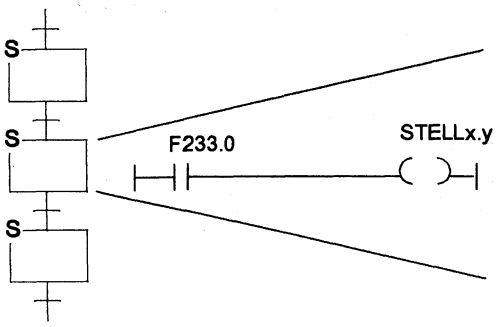
SB-Filter



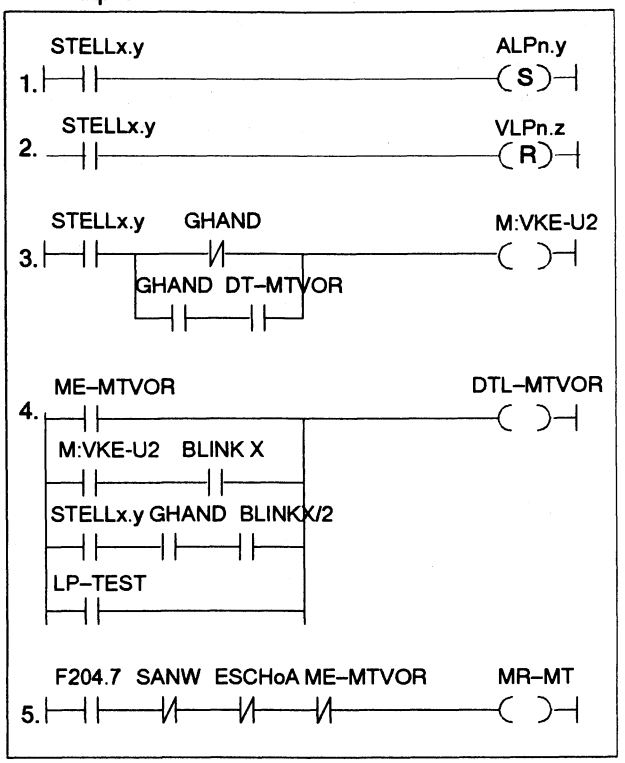
Working movement

SB-sequencer → AUTO

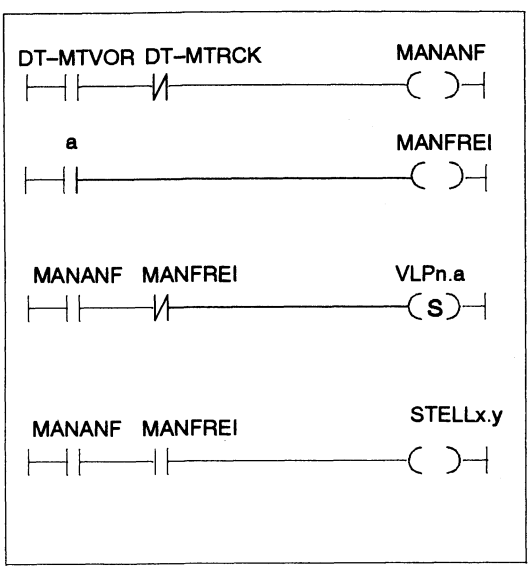
Movement: FORWARDS



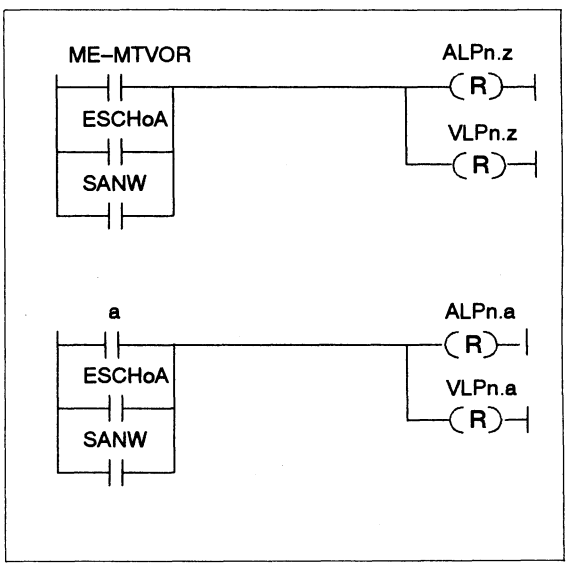
PB-Output



PB-Manual



SB-Filter



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5.5 Empfehlungen für die Programmdokumentation: Symboloperanden

Representation conventions

The sole purpose of observing conventions when defining operands and parameters is to achieve software and documentation which can be easily read and understood. Operands should bear names which give the maintenance personnel as most information as possible on the meaning of the assigned signal or flag.

The entire program system should be printed out with the standard or convenient documentation functions of STEP 5 (as from vers. 6.0) or under the option package KOMDOK. The application example shows examples for the representation of segments with operand comments etc.

Section 4.4

Standardized abbreviation for command intermediary

The abbreviations summarized in the following table for the "Command intermediary" are recommended. Apart from the German abbreviations the character combinations acc. to the IEC standard are given.

Attention: The various command intermediaries cannot be decoded unambiguously when using IEC abbreviations (e.g. 3 x SQ). The user must then decide from case to case which representation is to be used.

German abbre-viation	Abbreviation acc. to IEC standard	Comment
ME	SQ	Mechanical limit switch
DK	SP	Pushbutton switch
NS	SQ	Proximity switch
MV	M-F	Motor forward
MR	M-R	Motor return
VR	K-F	Activate relay forward
RR	K-R	Activate relay return
SS	SA	Key switch
L	HL	Lamp
DT	SB	Pushbutton
LS	K-T	Light barrier
SA	QF	Miniature circuit barrier
MS	QM	Motor circuit barrier
NA	SB	Emergency off
SG	SQ	Guard switch
Y	YA	Valve coil
TH	ST	Thermostatic switch
WS	B	Flow rate monitor
GS	KM	Group contactor

Abbreviations

A

Abbreviations used in the manual

DB	=	Data block
DBGEN	=	Function on programmer for generating DBs
DT	=	Pushbutton
DW	=	Data word
EDDI	=	Error Dynamic Diagnostic Indication
FB78	=	Function block GRAPH5-EDDI
G5E	=	GRAPH5-EDDI
GRAPH5/II	=	SW package for programming and planning sequencers
HW	=	Hardware
ILP	=	Interlock lamp
I-Matrix	=	Interlock matrix
LAD	=	Ladder diagram
O&M	=	Operation and monitoring
OB	=	Organization block
PB	=	Program block
PG	=	Programmer
PLC	=	Programmable controller
RSLP	=	Blank out (reset) sequence lamp
SB	=	Sequence block (created in GRAPH5/II)
SB8	=	Standard sequence block GRAPH5-EDDI
SLP	=	Sequence lamp
S-Matrix	=	Sequence matrix
STEP 5-MT	=	STEP 5 multitasking system
STEP 5-ST	=	STEP 5 singletasking system
STL	=	Statement list
SW	=	Software
TM	=	Monitoring time
TW	=	Waiting time
ZULI	=	Assignment list

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