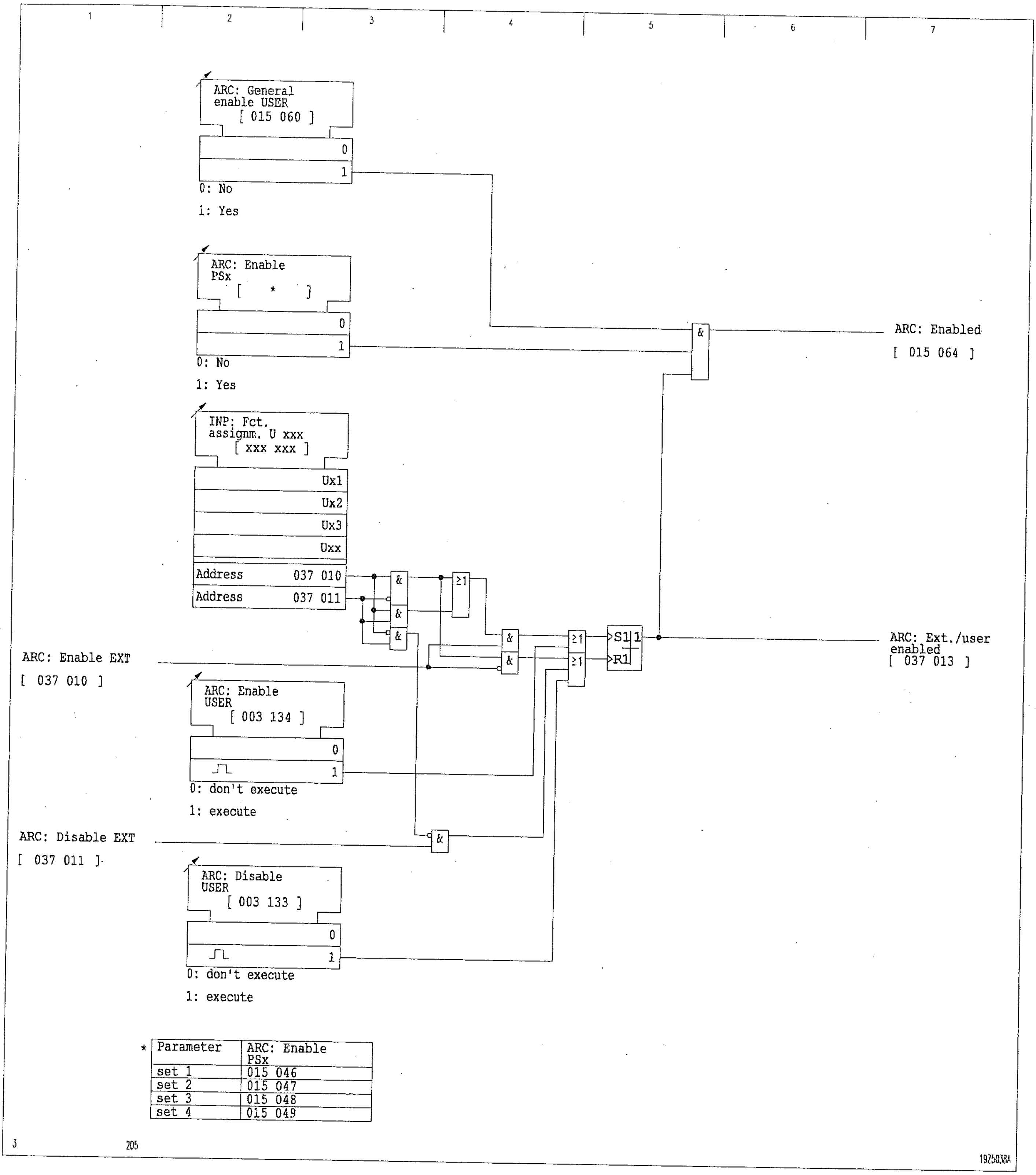
Disabling and enabling the ARC function

The function can be disabled or enabled from the integrated local control panel or through binary signal inputs.

Activation is enabled independent of parameter subset via ARC: General enable USER. Activation is enabled for parameter subset PSx via ARC: Enable PSx. Subsequently, the ARC can be enabled via the local control panel or through appropriately configured binary signal inputs. Enabling from either the integrated local control panel or through binary signal inputs is equally effective. If only ARC: Enable EXT is assigned to a binary signal input then the ARC will be enabled by a positive edge of the input signal; it will be disabled by a negative edge. If only ARC: Disable EXT is assigned to a binary signal input then a signal present at the input will have no effect.



* Parameter	ARC: Enable PSx
set 1	015 046
set 2	015 047
set 3	015 048
set 4	015 049

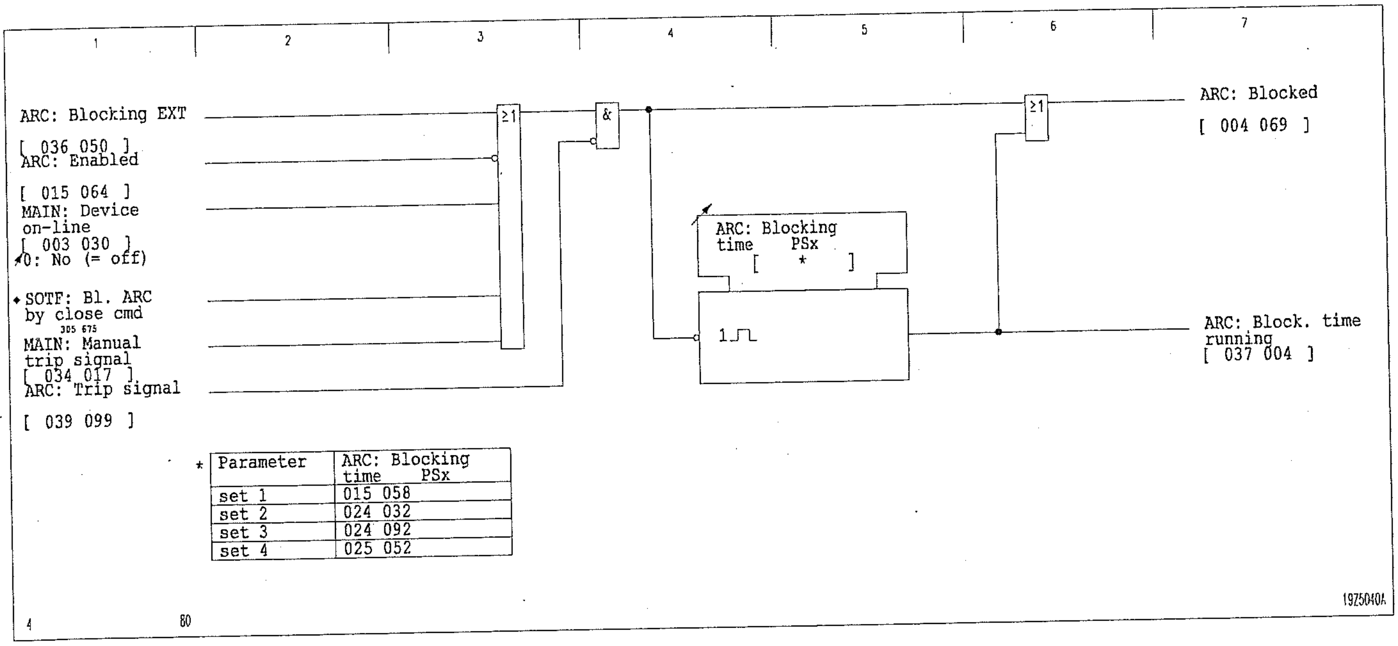
3-123 *Enabling or disabling auto-reclosing control*

ARC blocking

Under certain conditions the ARC will be blocked and the signal ARC: Blocked will be generated, provided that one of the following conditions is met:

- A blocking signal is present through manual close.
- There is an external signal ARC: Blocking EXT.
- The ARC is not activated.
- Protection is disabled (off).
- A manual trip command is issued from the local control panel.

After all blocking conditions have dropped out, the blocking time is started. When the blocking time has elapsed, ARC blocking is canceled.



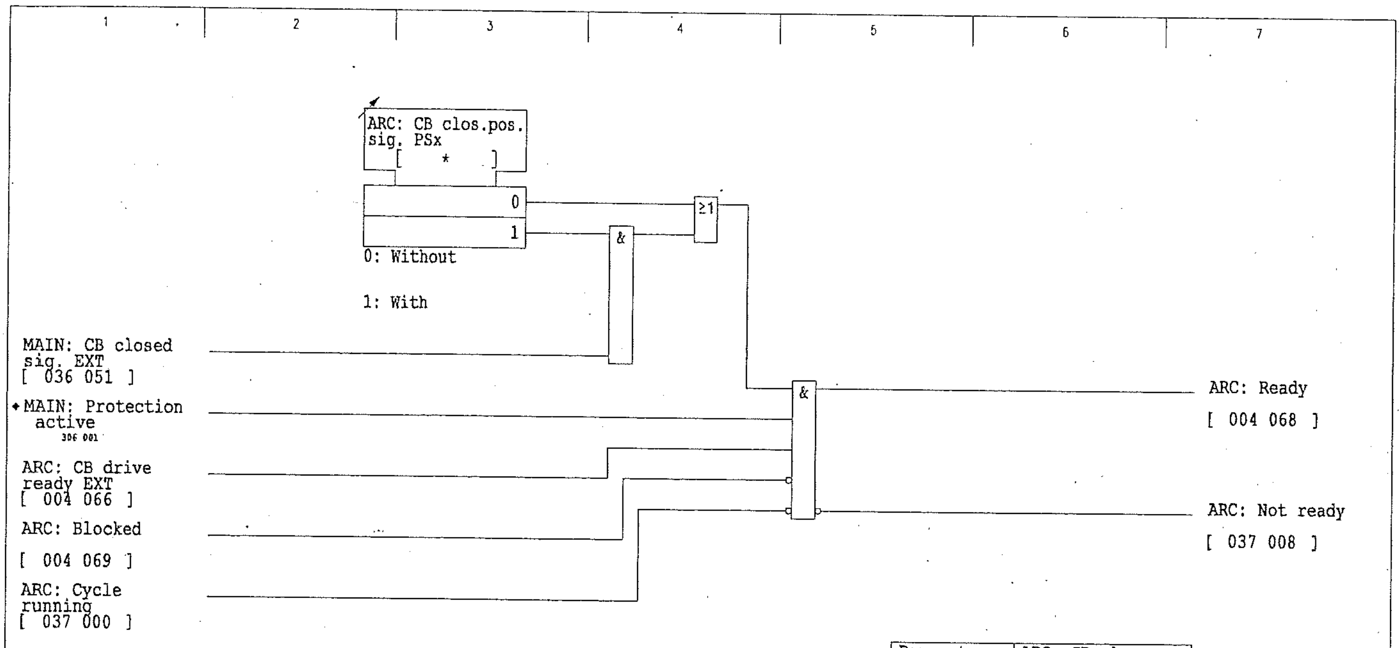
* Parameter	ARC: Blocking time PSx
set 1	015 058
set 2	024 032
set 3	024 092
set 4	025 052

3-124 *ARC blocking*

ARC ready to operate

An ARC cycle can only start if the ARC is ready. For this purpose the following conditions need to be met simultaneously:

- Protection is activated (on).
- The ARC is not blocked.
- The circuit breaker must be capable of opening and closing again (CB opening & closing mechanism ready).
- The circuit breaker must be in closed position (closed position scanning is optional).
- No ARC cycle is running.



* Parameter	ARC: CB clos.pos. sig. PSx
set 1	015 050
set 2	024 024
set 3	024 084
set 4	025 044

3-125 *ARC ready to operate*

Tripping times

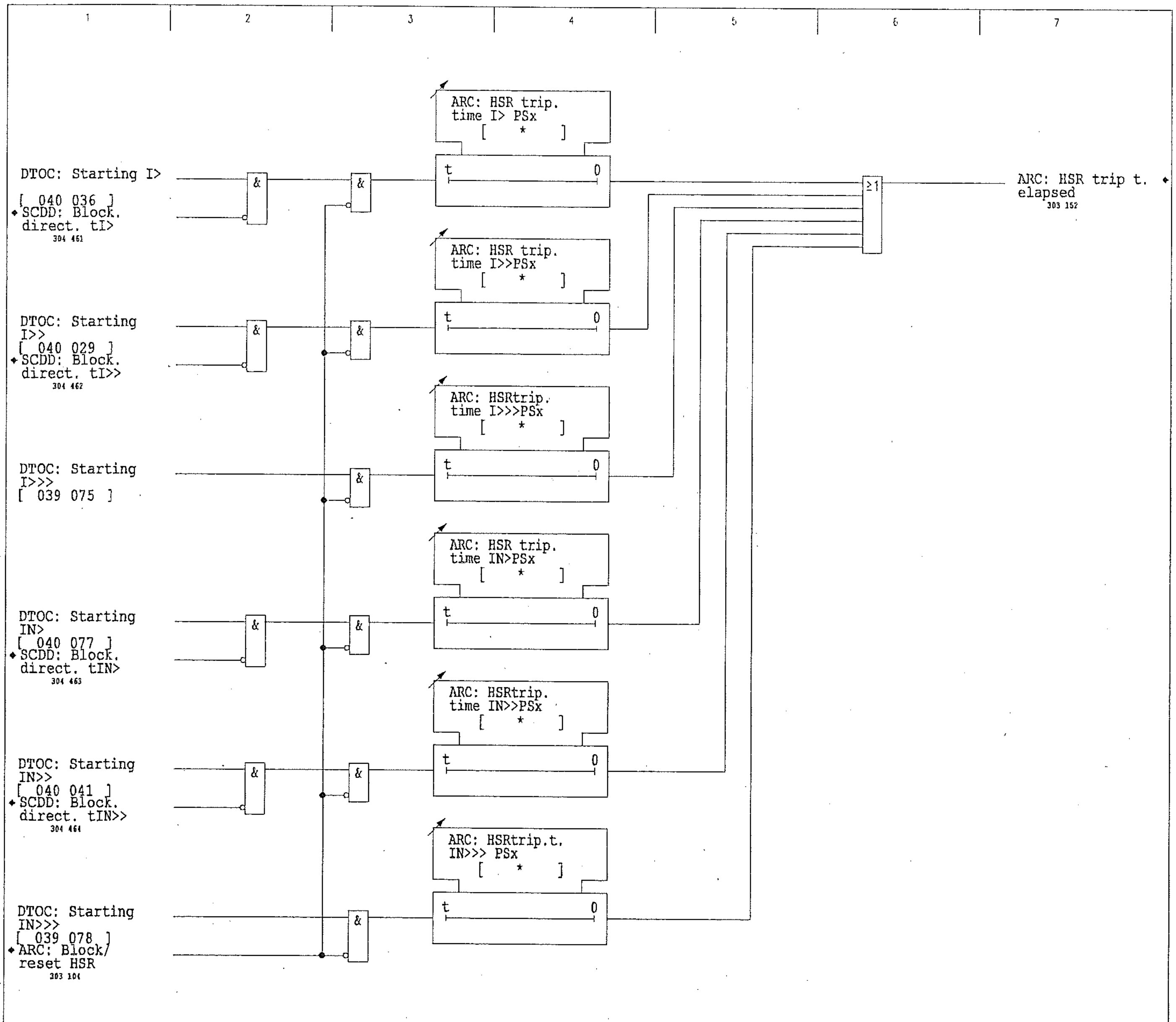
When protection functions operating with auto-reclosing control are started, the tripping times (HSR or TDR) are started together with the operative time. If the tripping time drops out within the active ARC cycle while the operative time is elapsing, a trip signal of defined duration is issued. The HSR or TDR trip time, having effected the trip signal, also determines the dead time (HSR or TDR). Once the dead time begins, all tripping times already triggered will be terminated as will the operative time.
The onset of the following startings or input signals trigger the tripping times provided that the starting conditions are met and the respective tripping times are not blocked. If short-circuit direction determination is enabled, then some of the starting signals are directional:

- General starting
- DTOC starting I> (directional)
- DTOC starting I>> (directional)
- DTOC starting I>>>
- DTOC starting I_N> (directional)
- DTOC starting I_N>> (directional)
- DTOC starting I_N>>>
- IDMT starting $I_{kIref,P}$> (directional)
- IDMT starting $I_{kIref,N}$> (directional)
- IDMT starting $I_{kIref,neg}$>
- Start by way of programmable logic
- Ground fault direction determination by steady-state values (GFDSS) has operated and detected one of the following faults:
  - GFDSS starting fault 'forward/LS'
  - GFDSS starting Y(N)>
  - GFDSS starting fault 'forward/LS' or GFDSS starting Y(N)>

If - in the operating mode *HSR/TDR permitted* - only one of the starting conditions listed above applies, then the first trip signal is always generated by the HSR trip timer stage, regardless of the duration of the HSR or TDR tripping time setting. HSR precedes TDR. If more than one starting is present then the trip signal will be issued after the HSR tripping time that has elapsed first. As an exception, a TDR will be triggered first after elapsing first, if the associated HSR tripping time is set to *Blocked*.

If the trip signal has been generated by a TDR tripping time stage, then no HSR will be initiated within the same ARC cycle.

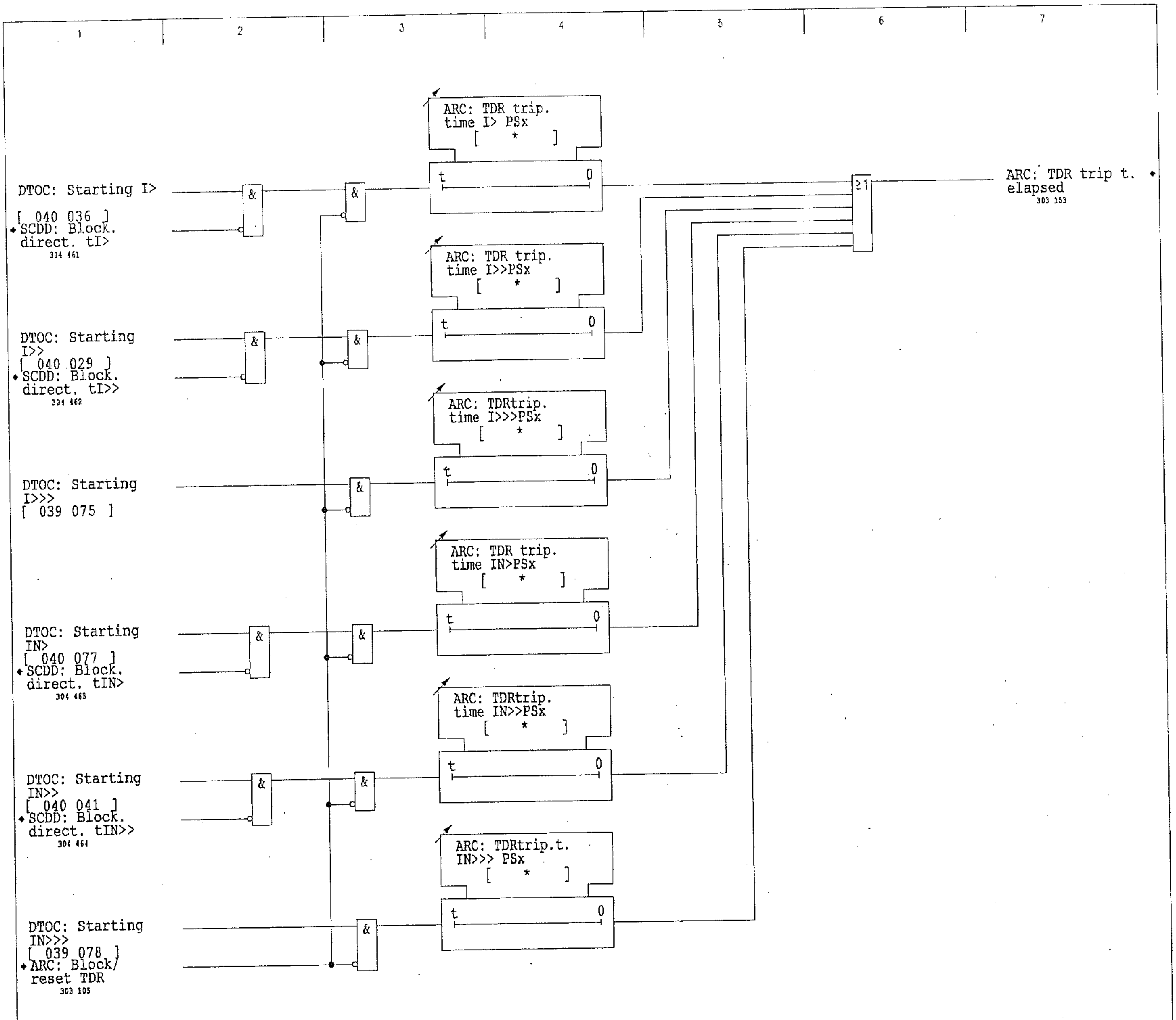
The ARC trip signal must be included in the ‘m out of n’ selection of the trip commands.



* Parameter	ARC: HSR trip. time I> PSx	ARC: HSR trip. time I>>PSx	ARC: HSRtrip. time I>>>PSx	ARC: HSR trip. time IN>PSx	ARC: HSRtrip. time IN>>PSx	ARC: HSRtrip.t. IN>>> PSx
set 1	015 072	015 074	014 096	015 076	015 031	014 098
set 2	024 040	024 101	024 102	024 103	024 104	024 105
set 3	025 000	024 151	024 152	024 153	024 154	024 155
set 4	025 060	025 101	025 102	025 103	025 104	025 105

7 180 S8Z7515A

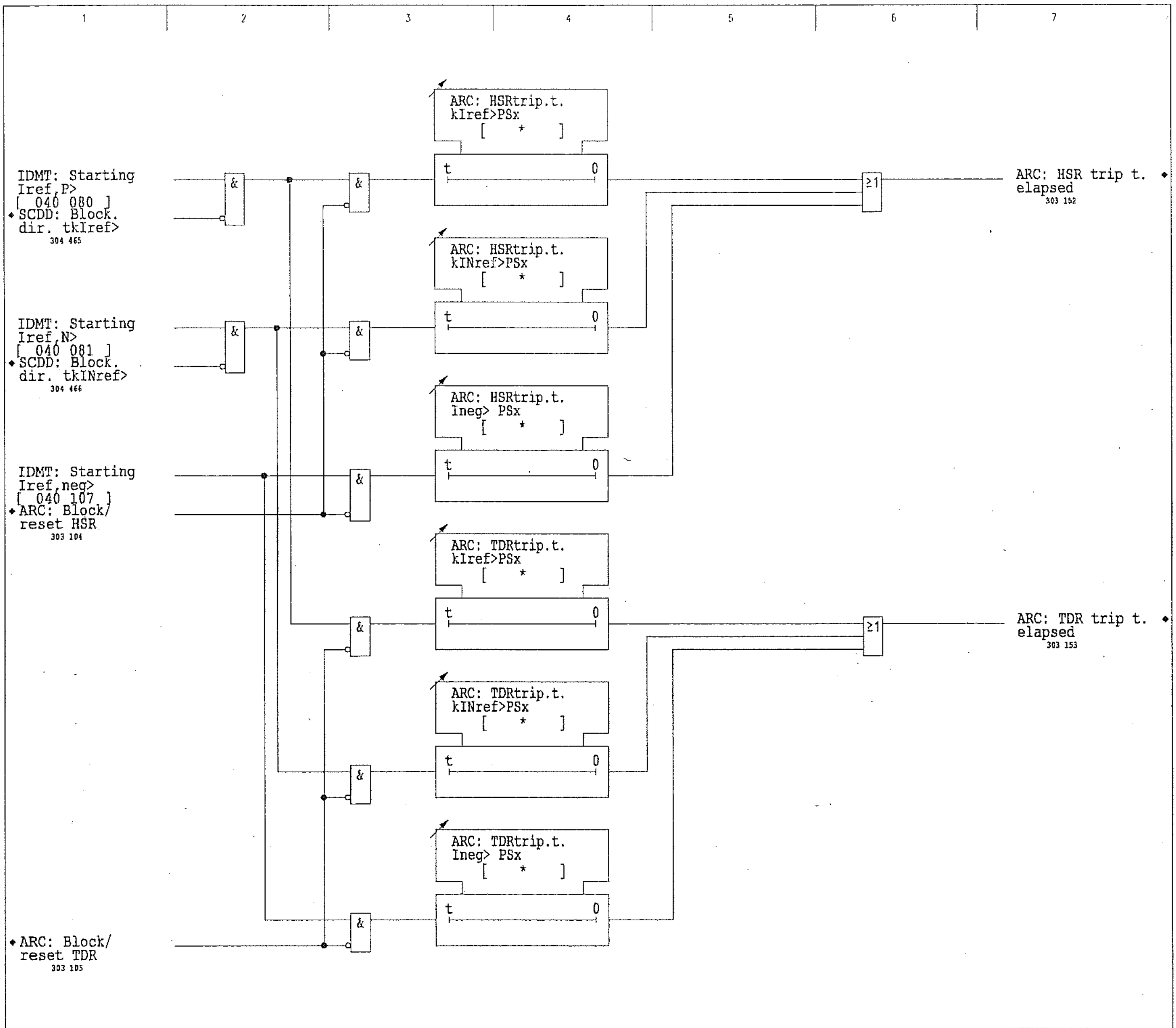
3-126 *HSR tripping times of the definite-time overcurrent protection function*



* Parameter	ARC: TDR trip. time I> PSx	ARC: TDR trip. time I>>PSx	ARC: TDRtrip. time I>>>PSx	ARC: TDR trip. time IN>PSx	ARC: TDRtrip. time IN>>PSx	ARC: TDRtrip.t. IN>>> PSx
set 1	015 073	015 075	014 097	015 077	015 032	014 099
set 2	024 041	024 113	024 114	024 115	024 116	024 117
set 3	025 001	024 163	024 164	024 165	024 166	024 167
set 4	025 061	025 113	025 114	025 115	025 116	025 117

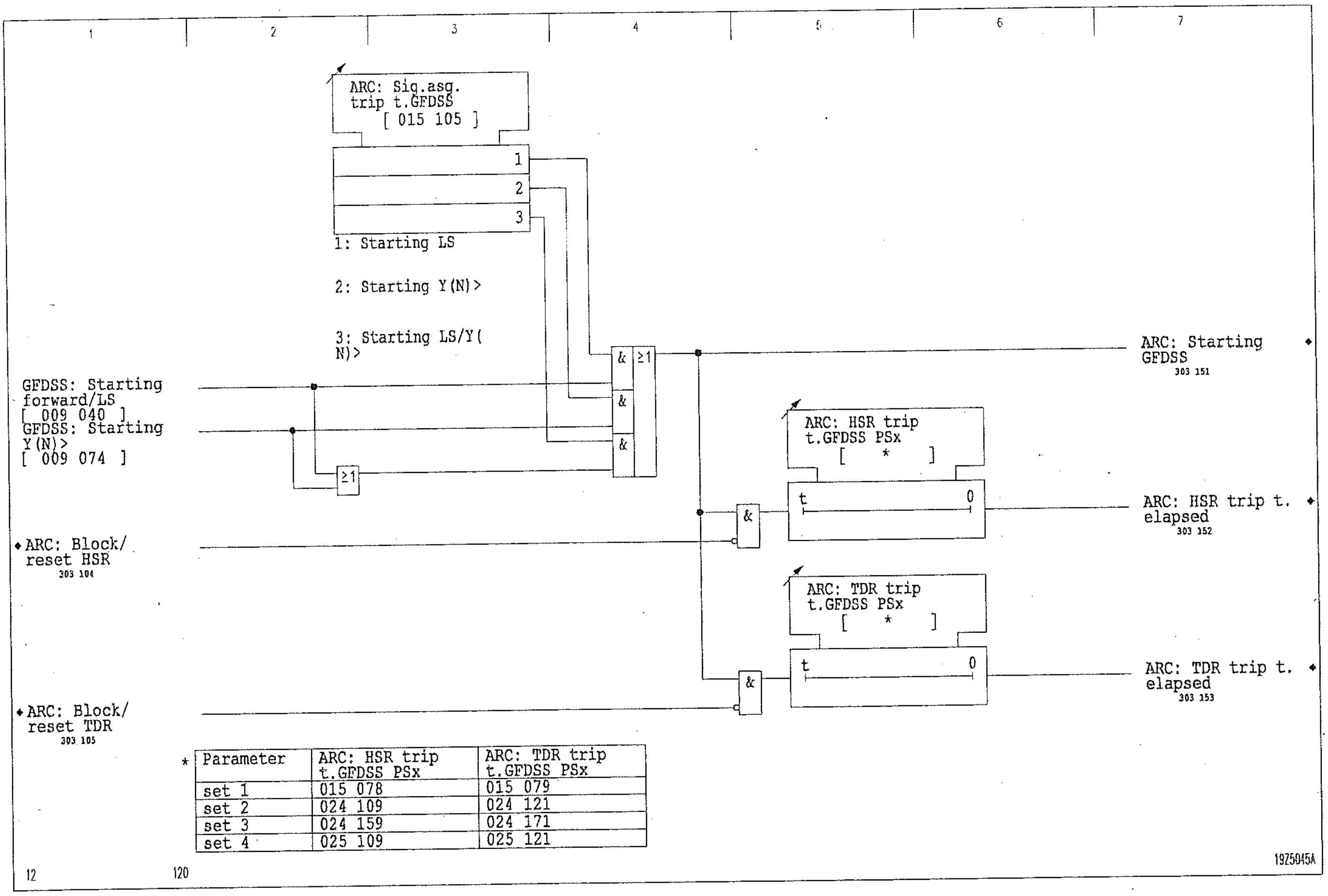
9 180 S877516A

3-127 *TDR tripping times of the definite-time overcurrent protection function*



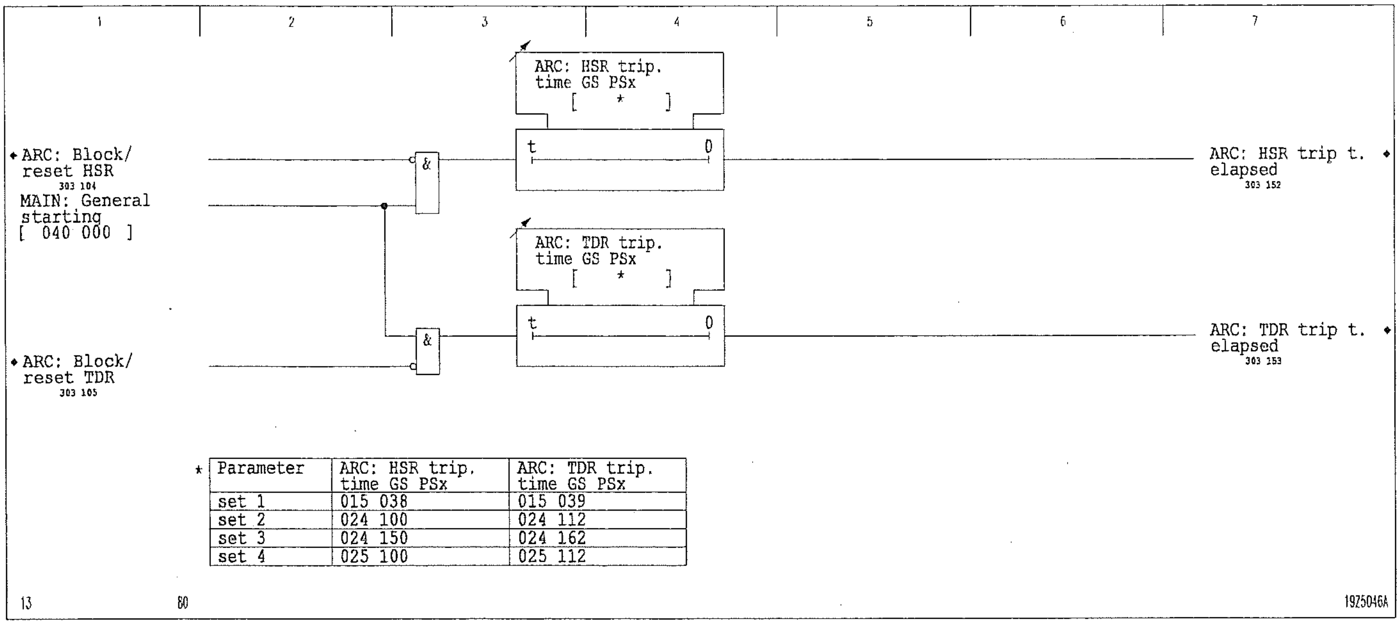
* Parameter	ARC: HSRtrip.t. kIref>PSx	ARC: HSRtrip.t. kINref>PSx	ARC: HSRtrip.t. Ineg> PSx	ARC: TDRtrip.t. kIref>PSx	ARC: TDRtrip.t. kINref>PSx	ARC: TDRtrip.t. Ineg> PSx
set 1	015 094	015 096	015 034	015 095	015 097	015 035
set 2	024 106	024 107	024 108	024 118	024 119	024 120
set 3	024 156	024 157	024 158	024 168	024 169	024 170
set 4	025 106	025 107	025 108	025 118	025 119	025 120

3-128 *Tripping times of the inverse-time overcurrent protection function*



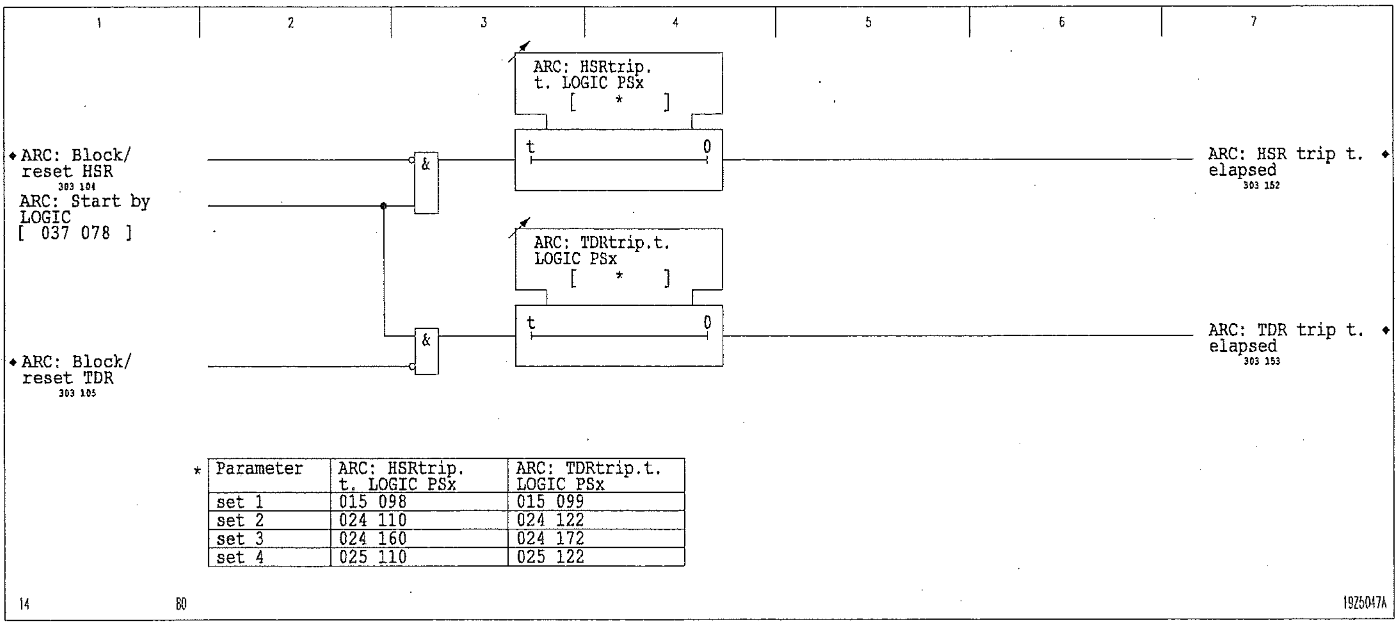
* Parameter	ARC: HSR trip t.GFDSS PSx	ARC: TDR trip t.GFDSS PSx
set 1	015 078	015 079
set 2	024 109	024 121
set 3	024 159	024 171
set 4	025 109	025 121

3-129 *Tripping times of the GFDSS function (ground fault direction determination using steady-state values)*



Parameter	ARC: HSR trip. time GS PSx	ARC: TDR trip. time GS PSx
set 1	015 038	015 039
set 2	024 100	024 112
set 3	024 150	024 162
set 4	025 100	025 112

3-130 *Tripping times of general starting*



Parameter	ARC: HSRtrip. t. LOGIC PSx	ARC: TDRtrip.t. LOGIC PSx
set 1	015 098	015 099
set 2	024 110	024 122
set 3	024 160	024 172
set 4	025 110	025 122

3-131 *Tripping times via the LOGIC function*

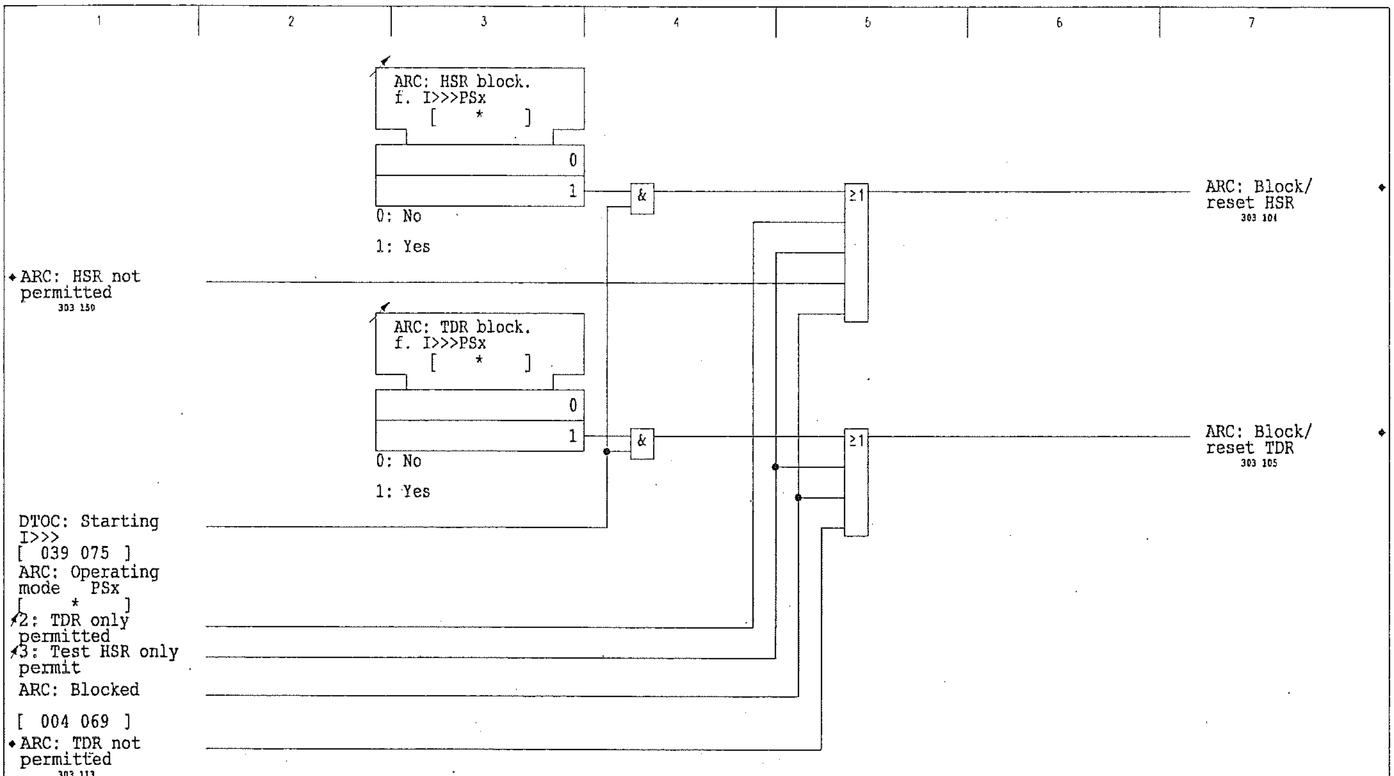
Blocking and resetting the tripping times

The HSR tripping time stages are blocked or reset either by the set value *Blocked* or by one of the following conditions:

- ARC: Operating mode PSx is set to *Test HSR only permitted.*
- I>>> starting is present and ARC: HSR blocking by I>>> PSx has been selected.
- ARC: Operating mode PSx is set to *TDR only permitted.*
- An HSR is not permitted because an HSR or TDR has already occurred within the current ARC cycle.
- The ARC is blocked.

The TDR tripping time stages are blocked or reset either by the set value *Blocked* or by one of the following conditions:

- ARC: Operating mode PSx is set to *Test HSR only permitted.*
- I>>> starting is present and ARC: TDR blocking by I>>> PSx has been selected.
- The ARC is blocked.
- The number of permitted TDRs has been reached and thus no further TDRs are permitted.



* Parameter	ARC: HSR block. f. I>>>PSx	ARC: TDR block. f. I>>>PSx	ARC: Operating mode PSx
set 1	015 080	015 081	015 051
set 2	024 111	024 124	024 025
set 3	024 161	024 174	024 085
set 4	025 111	025 124	025 045

15 120 19Z5048A

3-132 Blocking and resetting the tripping time stages

ARC cycle

An ARC cycle begins, provided that the starting condition is satisfied, with the presence of a relevant starting option (DTOC/IDMT starting, starting via programmable logic, GFDSS, or start of a test HSR), as long as the signal ARC: Ready is present at this time. As the ARC cycle proceeds, the signal ARC: Ready is no longer taken into account.

An ARC cycle is running if the ARC is not blocked and one of the following conditions is met:

- The operative time is running.
- A dead time is running.
- The reclaim time is running.

Blocking the DTOC or IDMT protection function, the GFDSS function, and programmable logic

If the ARC is ready, it will block the trip signals of DTOC and IDMT as well as those of the GFDSS and the programmable logic via the signal ARC: Blocking trip. The ARC permits the generation of a trip command by the other protection functions if one of the following conditions is met:

- ARC cycle running is not applicable, and the ARC is not ready.
- The final reclaim time is running.
- Only an HSR test is permitted (*Test HSR only*).
- The ARC is blocked.
- The operative time is elapsing while the tripping time is running.
- A relevant starting type begins while a dead time is running.
- One or more startings do not trigger a tripping time stage because the relevant tripping time stages are disabled (t set to *Blocked*). If a tripping time stage is started in this condition by additional starting, as long as no definitive trip command has been issued, a trip command is again generated by the ARC.

Example of programmable logic in the ARC

This example (see Figure 3-133) illustrates the possible interconnection and the binary signal output for starting the tripping time stage via a logic input.

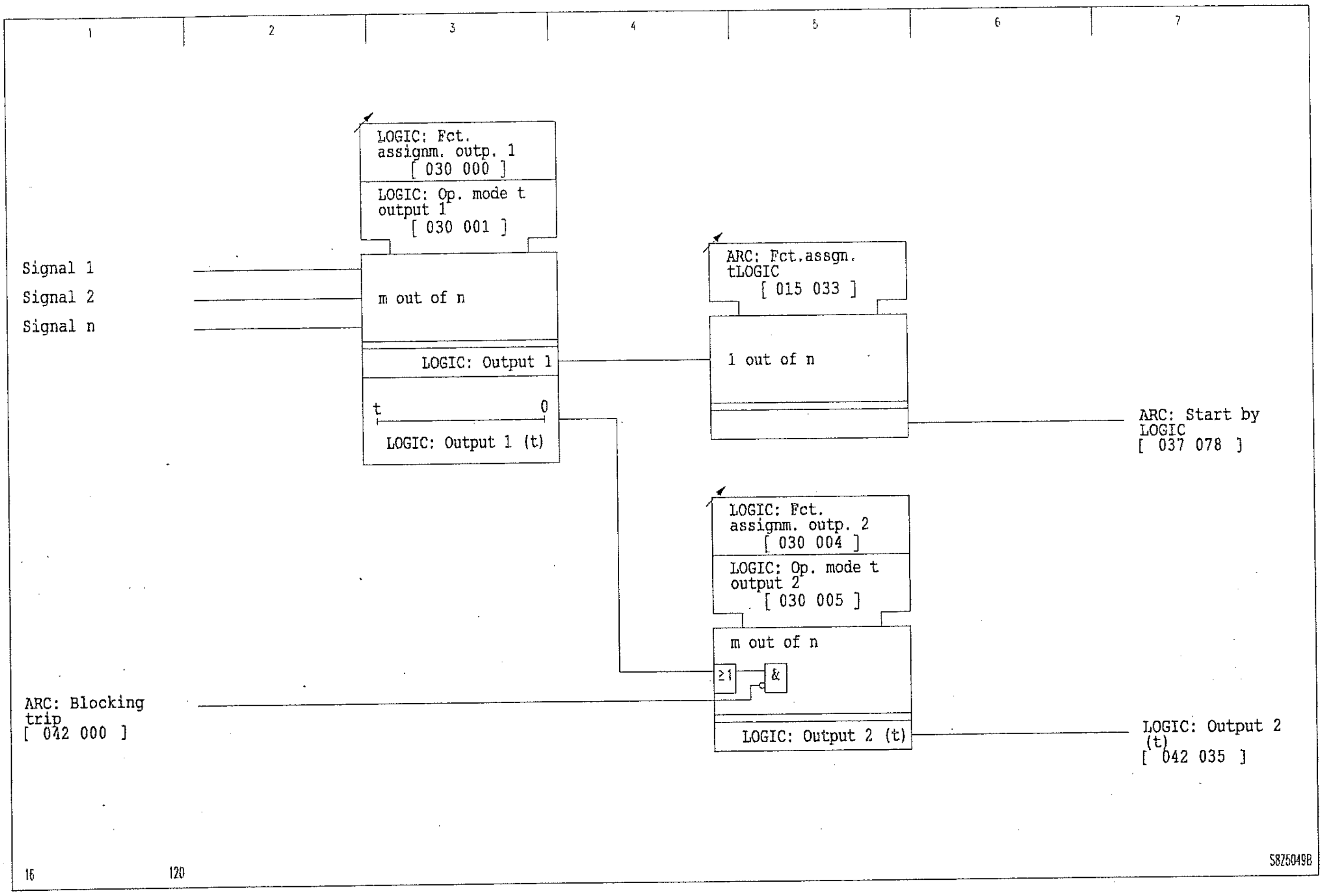
An input with serial operate delay and an AND element has been implemented by using the programmable logic function. At the second input of the AND element, the function ARC: Blocking trip has been connected in negation. The output of the AND element needs to be included in configuration of the 'm out of n' selection of the general trip command. The tripping time can be started by the output signal ARC: Start by logic.

For this example the following list parameters need to be set from the local control panel (see the section on 'Setting a List Parameter' in the chapter entitled 'Local Control').

	List Parameter	
LOGIC: Fct.assignm. output 1 (address 030 000)	OR	e.g. LOGIC: Input 4 EXT (address 034 003)
LOGIC: Fct.assignm. output 2	OR	LOGIC: Output 1 (t) (address 042 033)
	AND NOT	ARC: Blocking trip (address 042 000)

In general, any equation within the programmable logic function can be used to start the ARC tripping time.

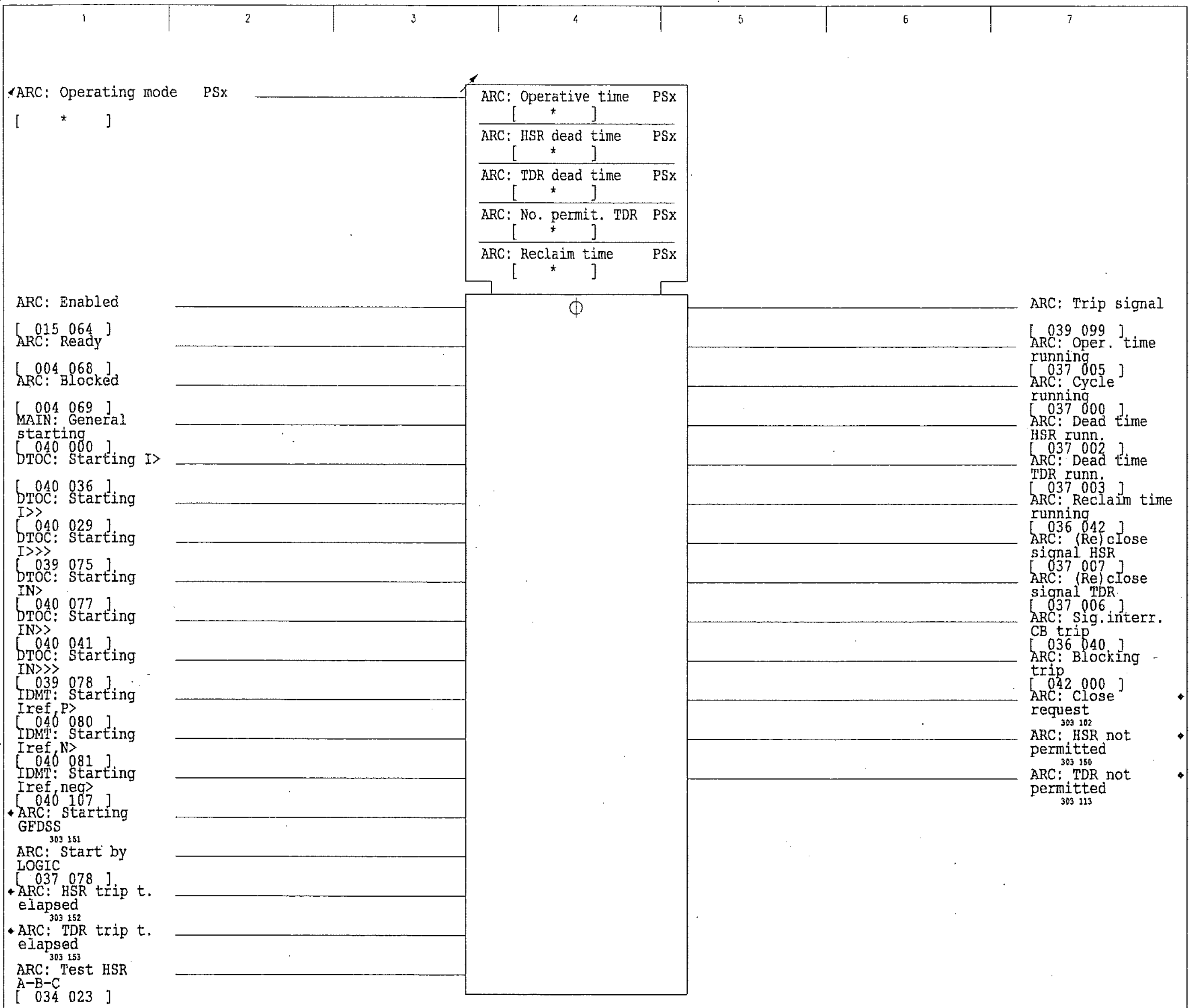
One of the options offered by the programmable logic is the triggering of the ARC by an external protection device.



3-133 *Example of programmable logic in the ARC*

General Control Functions

The entire ARC sequence is monitored and controlled by a sequence control function.



*

Parameter	ARC: Operating mode PSx	ARC: Operative time PSx	ARC: HSR dead time PSx	ARC: TDR dead time PSx	ARC: No. permit. TDR PSx	ARC: Reclaim time PSx
set 1	015 051	015 066	015 056	015 057	015 068	015 054
set 2	024 025	024 035	024 030	024 031	024 037	024 028
set 3	024 085	024 095	024 090	024 091	024 097	024 088
set 4	025 045	025 055	025 050	025 051	025 057	025 048

17 180 10Z5011A

3-134 ARC sequence control

3.26.1 High-Speed Reclosure (HSR)

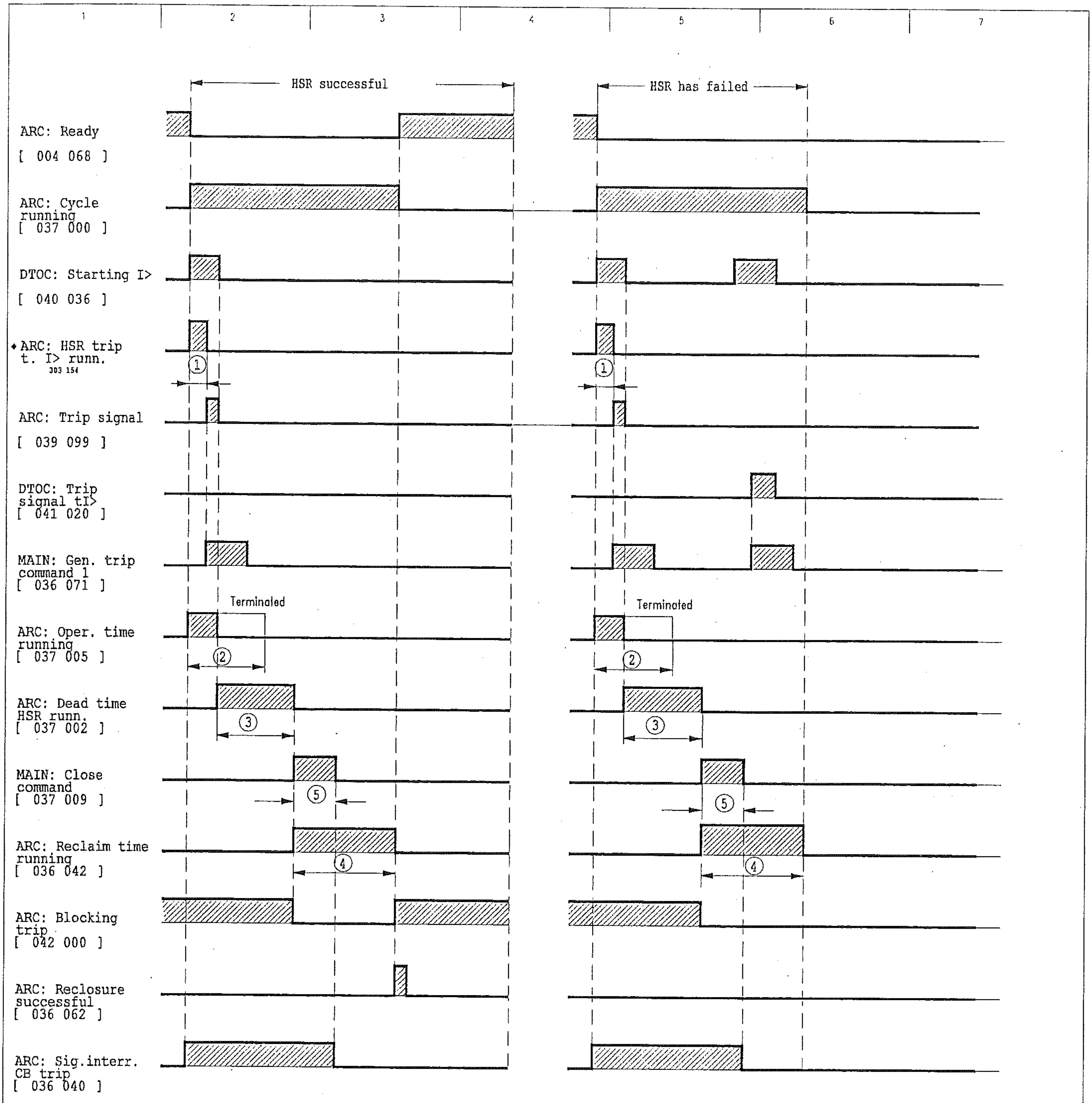
If the starting conditions are satisfied then any ARC-relevant protection startings will trigger an ARC cycle. The startings set off the associated tripping time stages and the operative time. If an HSR tripping time elapses during the operative time then the signal ARC: Trip signal is issued provided that the trip signal is configured accordingly. This signal can lead to a trip command if the function assignment for the trip commands is configured appropriately. As the starting drops out, the operative time is terminated and the HSR dead time begins. If there is no starting during the dead time, a reclosure command is issued once the dead time has elapsed. The reclaim time is started simultaneously. If there is no starting during the reclaim time, the signal ARC: Reclosure successful is issued and the ARC cycle is terminated once the reclaim time has elapsed.

If the HSR does not succeed and another starting occurs then a TDR is started if at least one TDR is permitted. If TDR after HSR is not permitted then the current reclaim time will be the last reclaim time of the ARC cycle. If the last reclaim time has elapsed and another starting occurs then the tripping time stages are no longer started. Instead the signal ARC: Blocking trip is set to a logic value of '0' and a trip by other protection functions is enabled. If a trip signal occurs during the last reclaim time then it will be regarded as a definitive trip. The ARC cycle is completed after the last reclaim time has elapsed.

When the signal ARC: Cycle running appears, the signal ARC: Sig.interr. CB trip (interruption breaker trip signal) is issued and is reset after the final HSR or TDR of the current ARC cycle once the close command pulse time has elapsed. When the signal ARC: Blocked appears during an ARC cycle, the signal is likewise immediately reset.

If the operative time elapses before the starting drops out, the last reclaim time will be started directly and the blocking of the protection trip signals is cancelled.

During the dead time, the P130C keeps checking whether any ARC-relevant startings occur. If this is the case, the last reclaim time is started and the blocking of the protection trip signals is cancelled.



	①	②	③	④
* Parameter	ARC: HSR trip. time I> PSx	ARC: Operative time PSx	ARC: HSR dead time PSx	ARC: Reclaim time PSx
set 1	015 072	015 066	015 056	015 054
set 2	024 040	024 035	024 030	024 028
set 3	025 000	024 095	024 090	024 088
set 4	025 060	025 055	025 050	025 048

⑤ MAIN: Close cmd.pulse time

ARC: No. permit. TDR PSx Setting: 0

18 220 S8Z7519A

3-135 HSR signal sequence

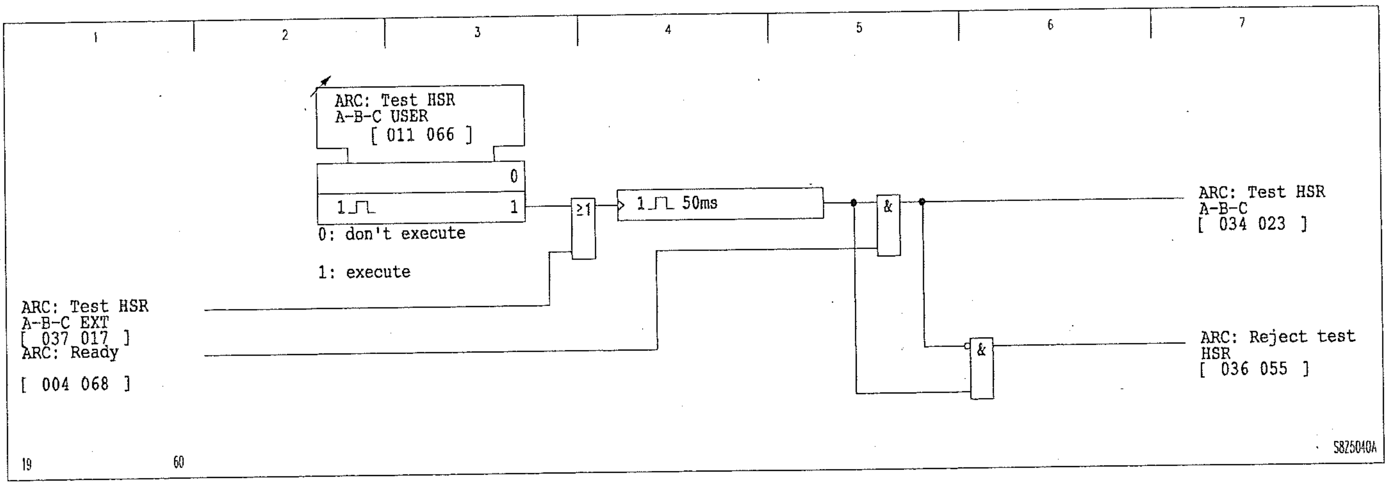
Test HSR

A test HSR can only be triggered when the ARC is ready to operate and if the operating mode has been set to *Test HSR only permit*. In this operating mode, the blocking of the trip signals of the DTOC, IDMT and other protection functions is cancelled so that any system fault can be properly cleared.

Once a test HSR has been triggered, a trip signal of defined duration is issued. The subsequent sequence corresponds to a successful HSR (open and reclose command once the HSR dead time has elapsed). Once the close command pulse time has elapsed, further triggering during the reclaim time does not result in another HSR.

A test HSR can be triggered either from the local control panel or via a binary input and adds an increment to the ARC: Number HSR counter.

Each 'Test HSR' request that does not result in a test HSR generates the signal ARC: Reject test HSR.



3-136 Test HSR

3.26.2 Time-Delay Reclosure (TDR)

Multiple reclosures using TDRs are possible if the operating mode is set accordingly. A TDR may occur after an HSR if reclosing has occurred as the result of the HSR. If the setting of the ARC operating mode allows only TDRs, then the TDR may occur immediately. In both cases, however, the setting for ARC: No. of permit. TDR PSx (Number of permitted TDRs) must not be equal to zero.

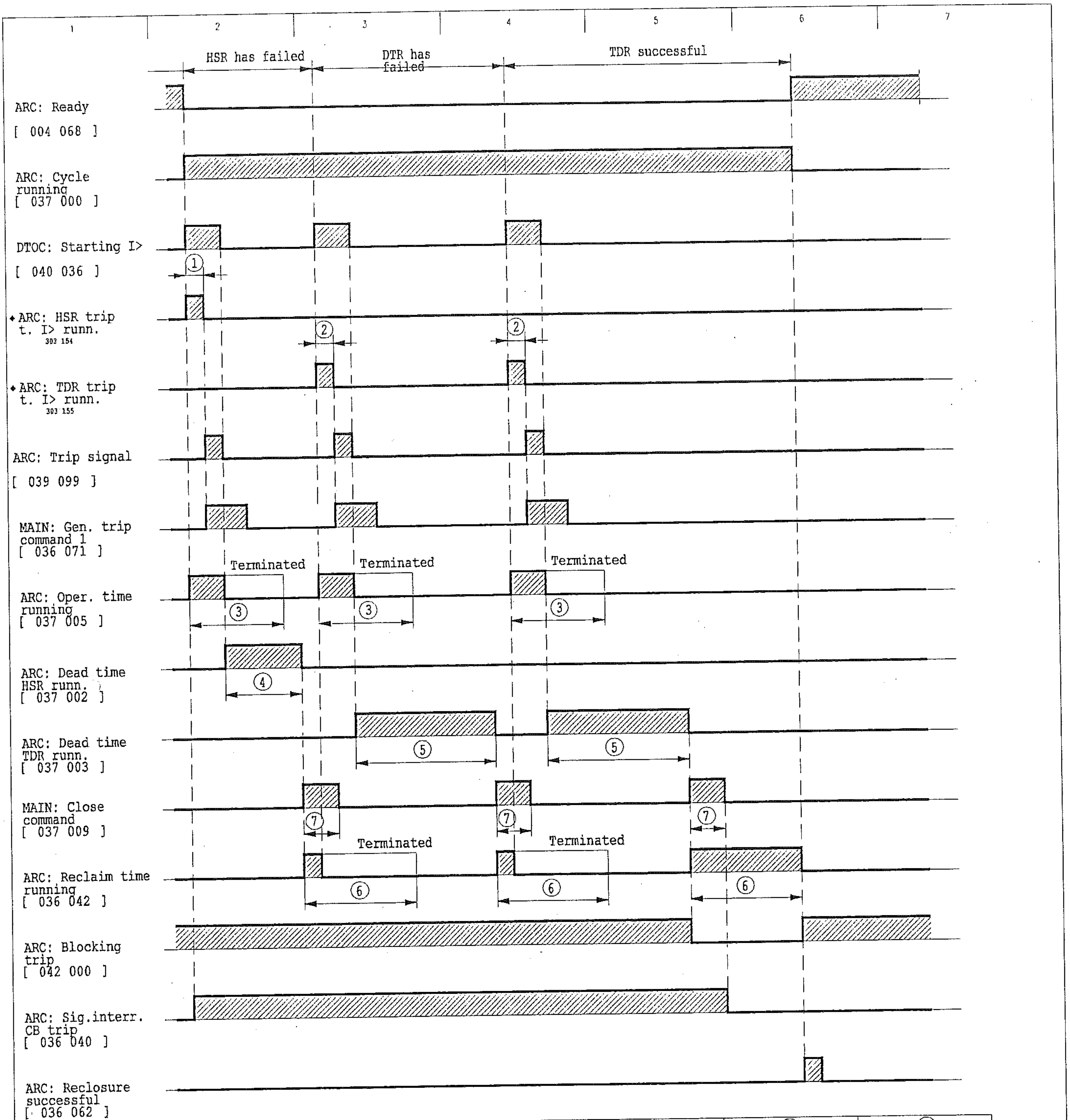
If the starting conditions are satisfied then any ARC-relevant protection startings will trigger the associated tripping times. The reclaim time is started simultaneously. If an TDR tripping time elapses during the operative time then the signal ARC: Trip signal is issued provided that the trip signal is configured accordingly. This signal can lead to a trip command if the function assignment for the trip commands is configured appropriately. As the starting drops out, the operative time is terminated and the TDR dead time begins. If there is no starting during the dead time, a reclosure command is issued once the dead time has elapsed. The reclaim time is started simultaneously. If no further TDR is permitted during the current ARC cycle then this will be the last reclaim time. If the last reclaim time has elapsed and another starting occurs then the tripping time stages are no longer started. Instead the signal ARC: Blocking trip is set to a logic value of ‘0’ and a definitive trip by other protection functions is enabled. If a trip signal occurs during the last reclaim time then it will be regarded as a definitive trip. The ARC cycle is completed after the last reclaim time has elapsed. If there is no starting during the last reclaim time, the signal ARC: Reclosure successful will be issued.

If there is a new starting during the reclaim time and at least one TDR is still permitted then the reclaim time is terminated and another trip is issued once the tripping time has elapsed. Once the dead time has elapsed, a further reclosure command is issued.

When the signal ARC: Cycle running appears, the signal ARC: Sig.interr. CB trip (interruption breaker trip signal) is automatically issued. It is reset after the final HSR or TDR of the current ARC cycle once the close command pulse time has elapsed. When the signal ARC: Blocked appears during an ARC cycle, the signal is likewise immediately reset.

If the operative time elapses before the starting drops out, the last reclaim time will be started directly and the blocking of the protection trip signals is cancelled.

During the dead time, the P130C keeps checking whether any ARC-relevant startings occur. If this is the case, the last reclaim time is started and the blocking of the protection trip signals is cancelled.



* Parameter	① ARC: HSR trip. time I> PSx	② ARC: TDR trip. time I> PSx	③ ARC: Operative time PSx	④ ARC: HSR dead time PSx	⑤ ARC: TDR dead time PSx	⑥ ARC: Reclaim time PSx
set 1	015 072	015 073	015 066	015 056	015 057	015 054
set 2	024 040	024 041	024 035	024 030	024 031	024 028
set 3	025 000	025 001	024 095	024 090	024 091	024 088
set 4	025 060	025 061	025 055	025 050	025 051	025 048

⑦ MAIN: Close cmd.pulse time

ARC: No. permit. TDR PSx Setting: 2

20 220 58Z7520A

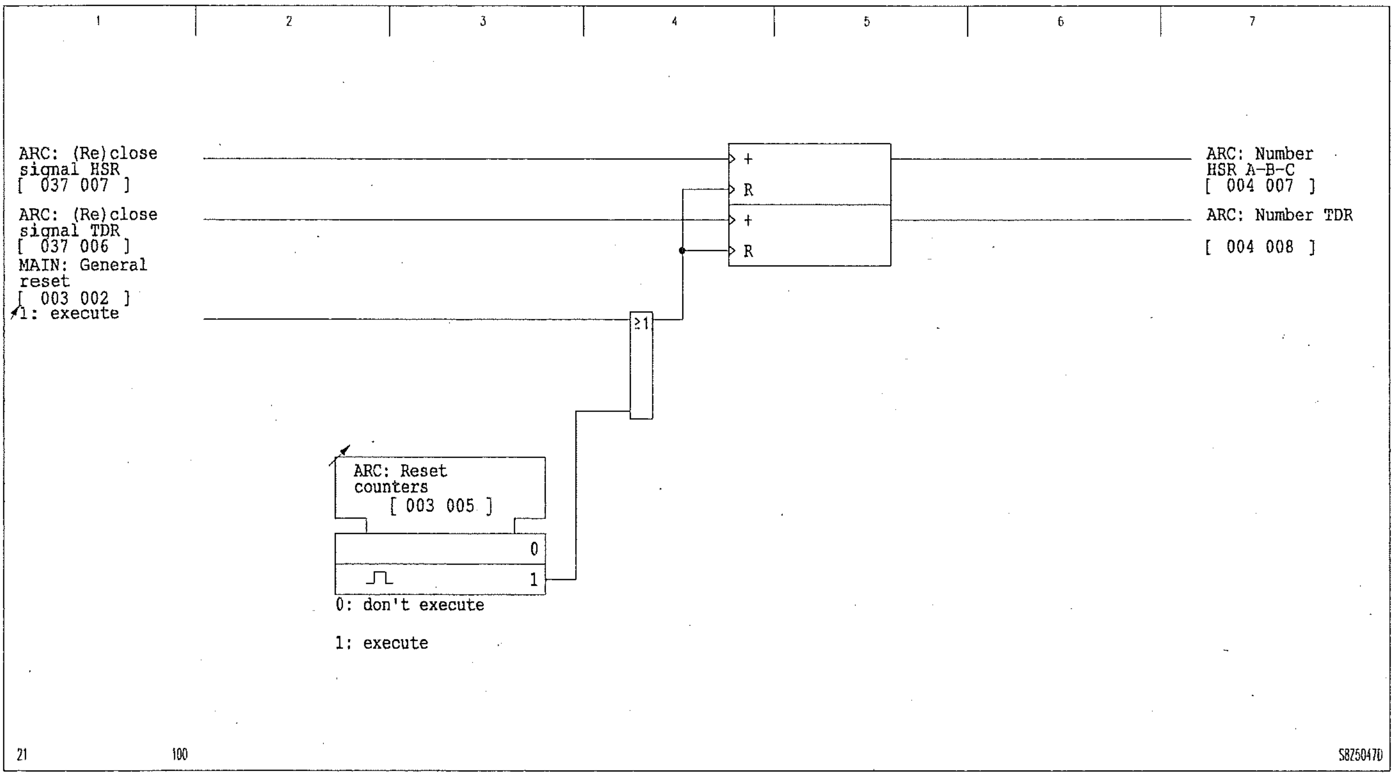
3-137 *Signal sequence of a failed HSR followed by a failed TDR and finally by a successful TDR*

3.26.3 ARC Counters

The following events are counted:

- Number of high-speed reclosures (HSR) that have been carried out.
- Number of time-delay reclosures (TDR) that have been carried out.

The associated counters can be reset individually or as a group.



3-138 ARC counters

3.27 Ground Fault Direction Determination Using Steady-State Values (Function Group GFDSS)

Ground fault direction is determined by evaluating the neutral displacement voltage and the residual current using the steady-state power evaluation method or, alternatively, the admittance evaluation method. As an alternative, it is also possible to detect ground faults (without direction determination in this case) using a steady-state evaluation method based solely on current (steady-state current evaluation). In that case only the filtered residual current is used as the ground fault criterion.

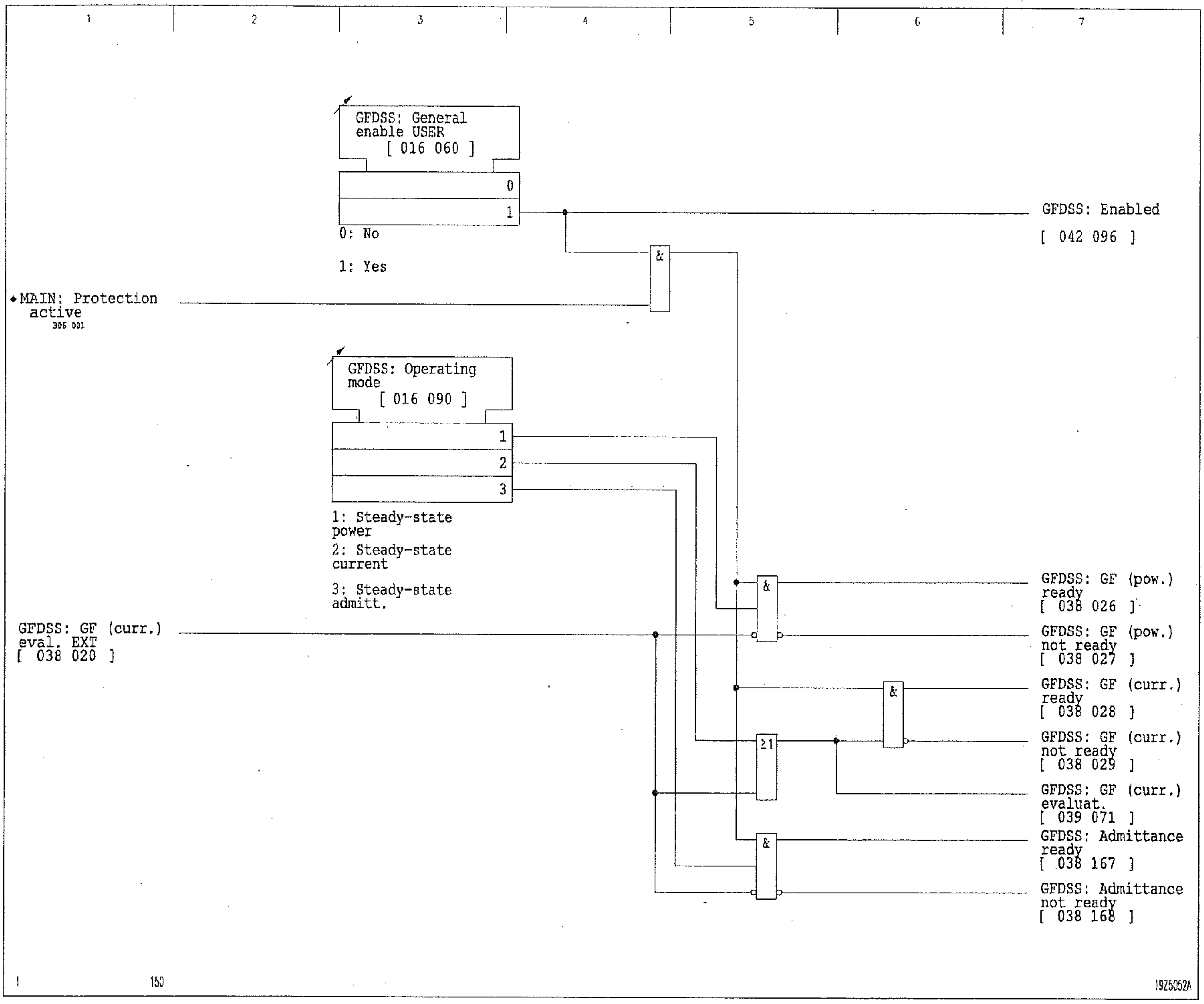
The functional sequence of ground fault direction determination can be influenced by the auto-reclosing control function.

Disabling and enabling ground fault direction determination using steady-state values

Ground fault direction determination using steady-state values (GFDSS) can be disabled or enabled from the local control panel. The user can switch to the current evaluation mode either from the local control panel or through an appropriately configured binary signal input.

Readiness of ground fault direction determination using steady-state values

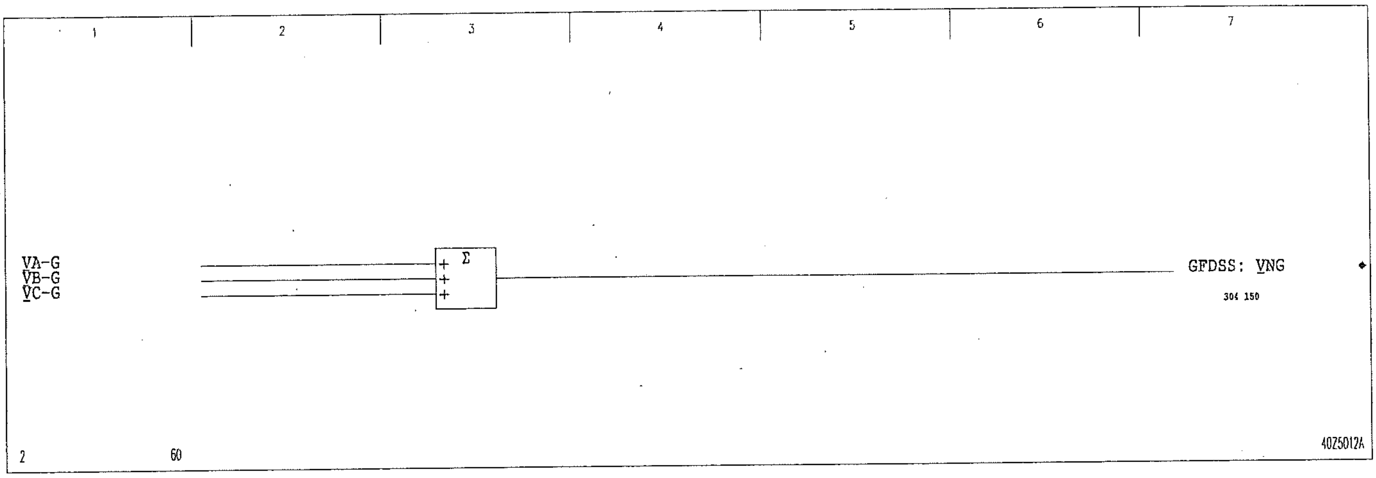
A readiness signal is issued for the selected evaluation mode if protection is active and if ground fault direction determination using steady-state values (GFDSS) is enabled.



3-139 Enabling, disabling and readiness of ground fault direction determination using steady-state values (GFDSS)

Conditioning of the measured variables

The neutral displacement voltage calculated by the P130C from the three phase-to-ground voltages is used for steady-state power evaluation. The current transformer is designed specifically for this application so that it has a low phase-angle error.

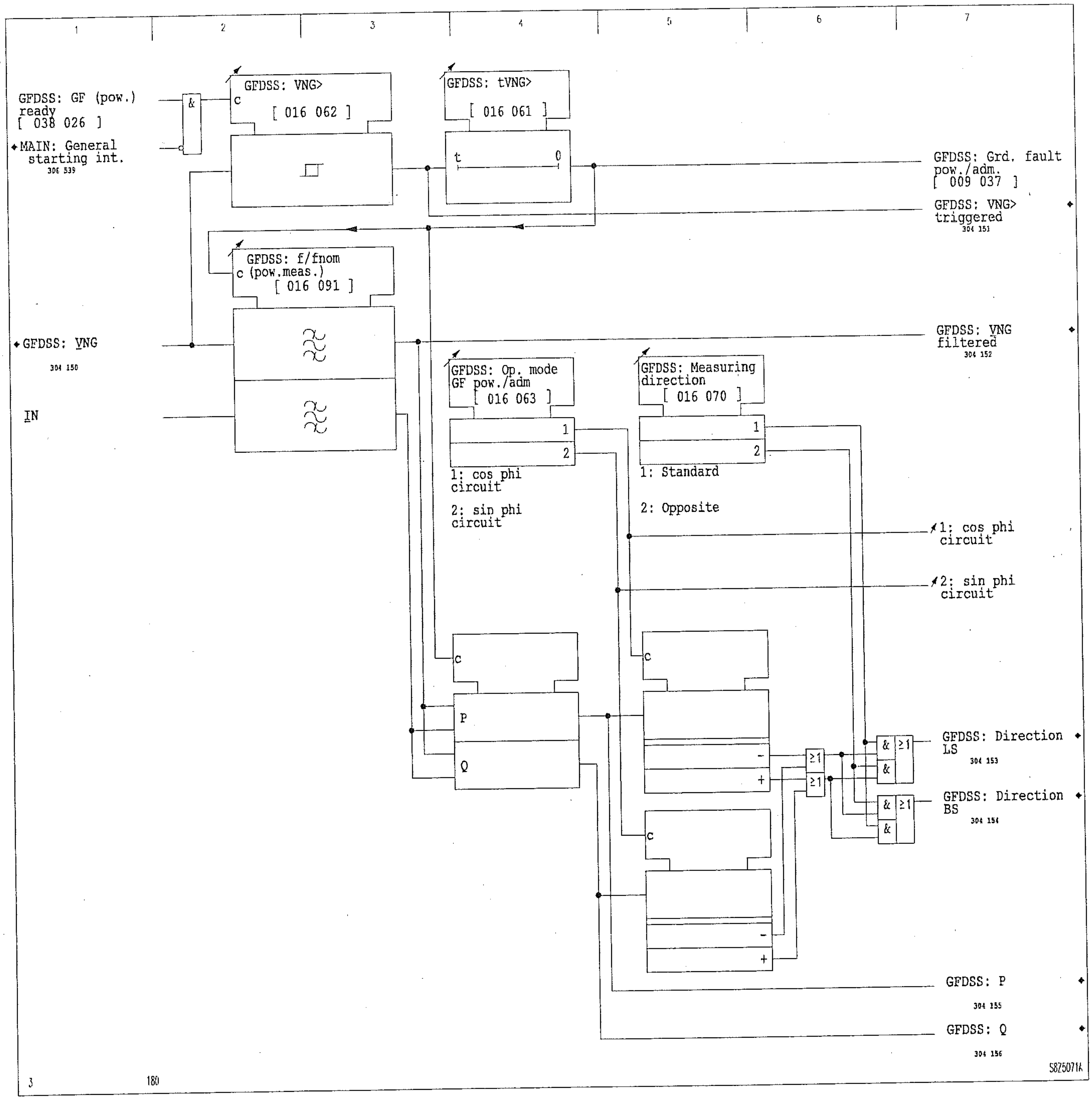


3-140 Conditioning of the measured voltage

3.27.1 Steady-State Power Evaluation

In order to detect the ground fault direction, ground fault direction determination by steady-state power evaluation requires the neutral-point displacement voltage and the residual current. The frequency given by the setting f/f_{nom} is filtered from these quantities using Fourier analysis. Three periods are used for analysis if the setting selected for the timer stage GFDSS: tVNG> is greater than or equal to 60 ms. This means that typical ripple control frequencies are suppressed in addition to all integer-frequency harmonics. If the timer stage has been set for values less than 60 ms, only one period is used for filtering purposes.

Measurement is enabled after timer stage tVNG> has elapsed; this stage is started by the trigger VNG>. The sign of either active power GFDSS: Oper. mode GF (pow.) *'cos phi circuit'* or reactive power GFDSS: Oper. mode GF (pow.) '*sin phi circuit'* is used for direction determination, depending on the operating mode selected – *cos phi circuit* or *sin phi circuit.* Connection of the measuring circuits is taken into account by the setting GFDSS: Measuring direction. With the standard connection, a decision for 'LS' is reached in the case of a ground fault on the line side and 'BS' in the case of a ground fault on the busbar side.

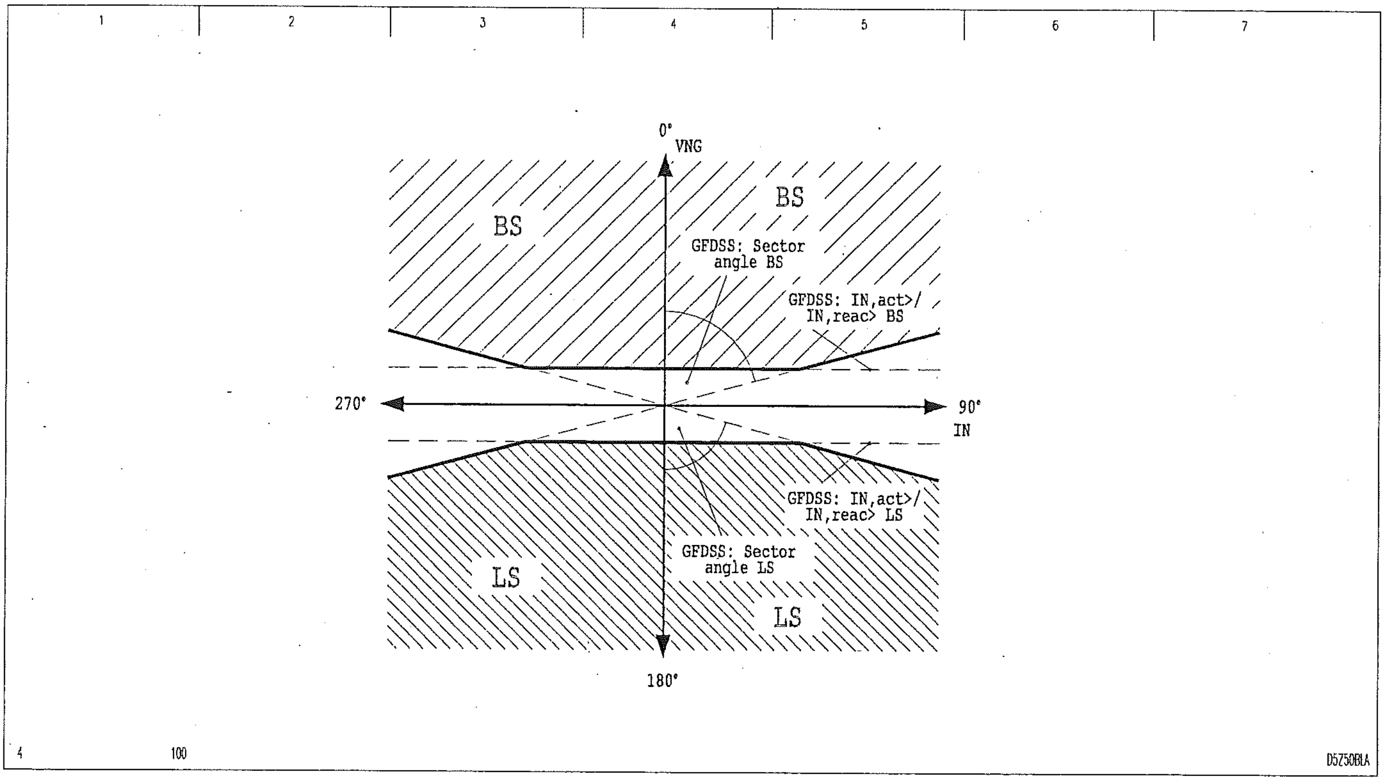


3-141 Direction determination in the power evaluation mode *cos φ circuit*

The direction decision is not enabled until the active component of the residual current exceeds the set value and the phase displacement between residual current and neutral displacement current is smaller than the set sector angle. The sector angle makes it possible to extend the "dead zone" to take into account the expected phase-angle errors of the measured variables. These settings make it possible to achieve the characteristic shown in Figure 3-142.

Output of the direction decisions is operate- and release-delayed.

The trip signal of the GFDSS function for the forward direction is blocked by the auto-reclosing control function (ARC) if the ARC is able to form a trip command.

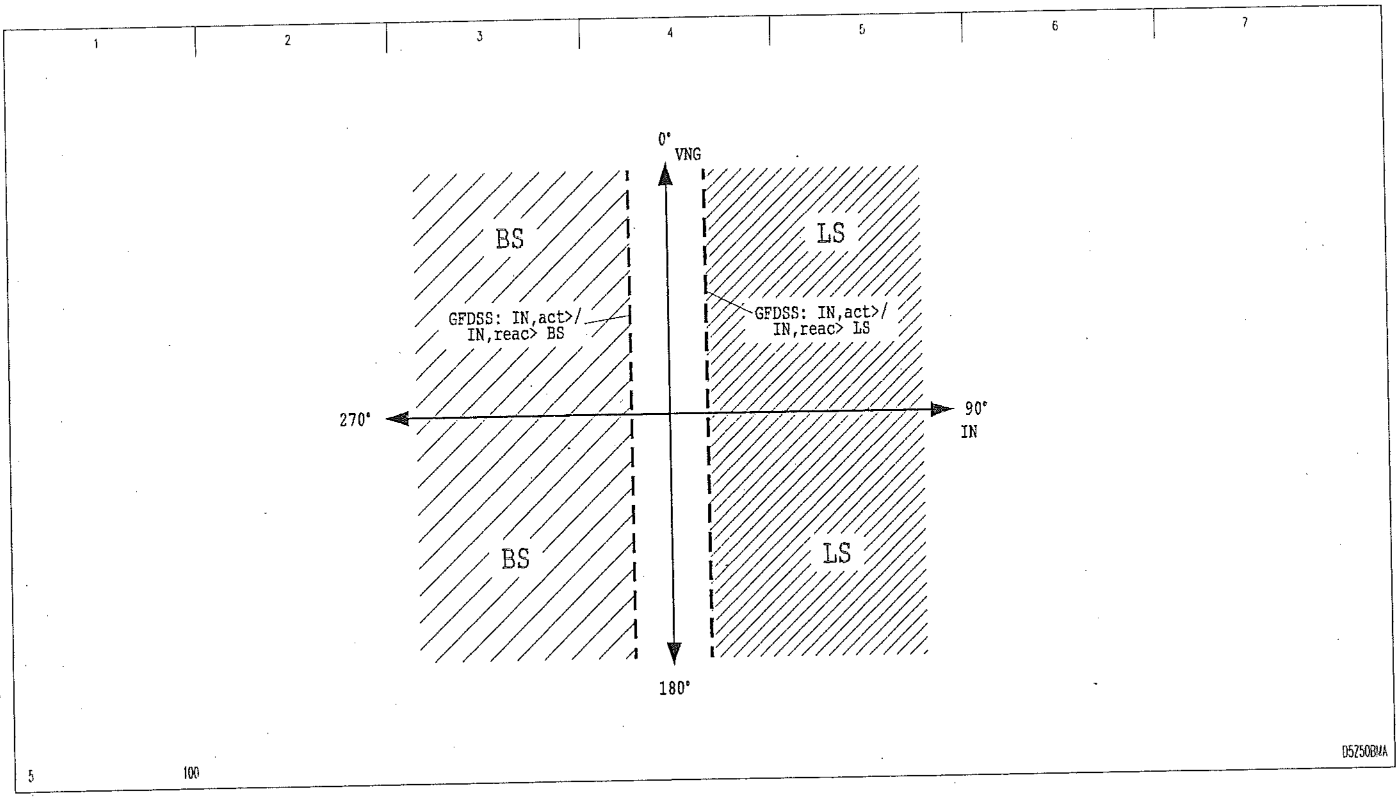


3-142 Characteristic of ground fault direction determination by steady-state power evaluation, operating mode cos φ *sin φ circuit*

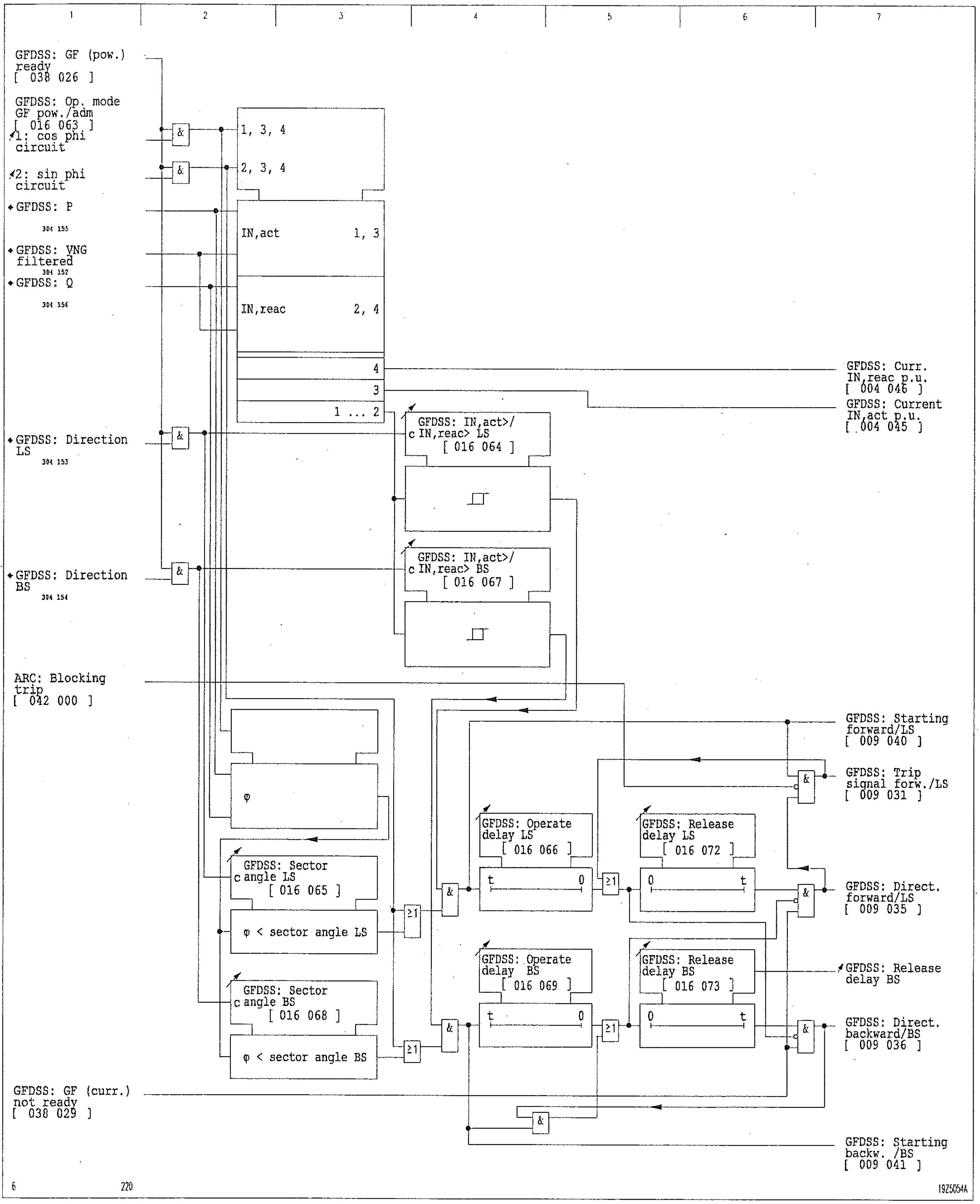
The direction decision is enabled if the reactive component of the residual current has exceeded the set threshold operate value. These settings make it possible to achieve the characteristic shown in Figure 3-143.

Output of the direction decisions is operate- and release-delayed.

The trip signal of the GFDSS function for the forward direction is blocked by the auto-reclosing control function (ARC) if the ARC is able to form a trip command.



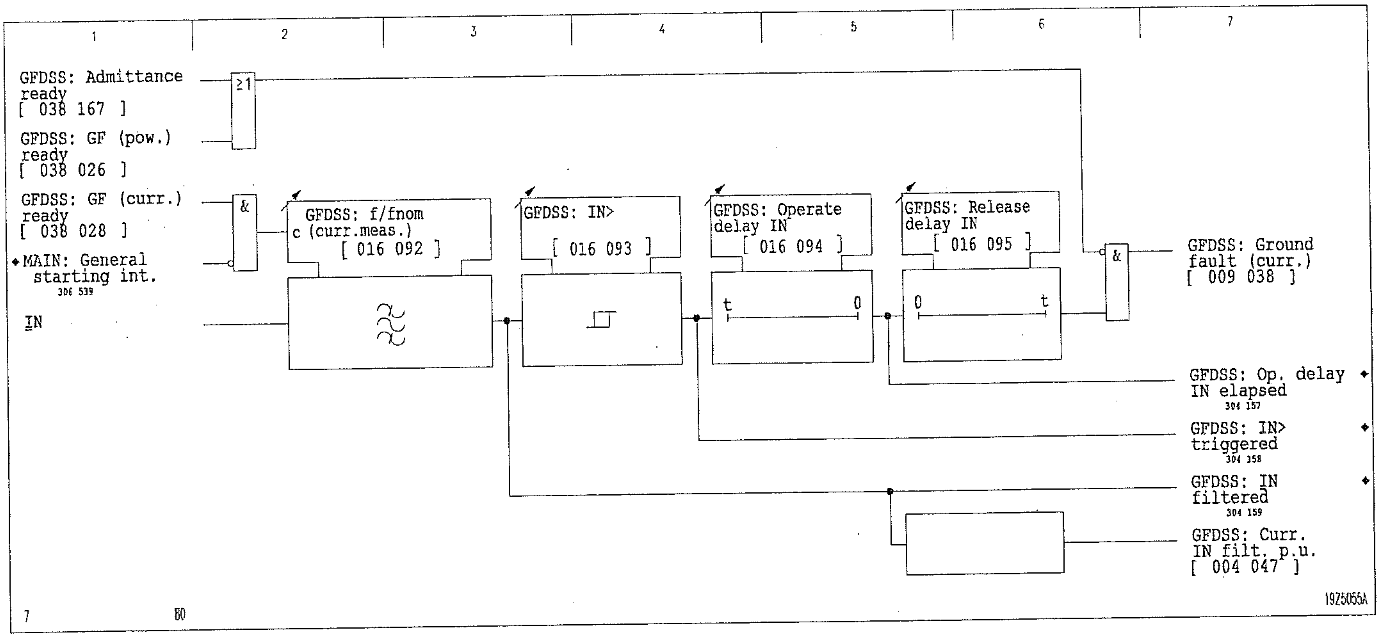
3-143 *Characteristic of ground fault direction determination by steady-state power evaluation, operating mode sin φ*



3-144 Output of direction decisions in the power evaluation mode

3.27.2 Steady-State Current Evaluation

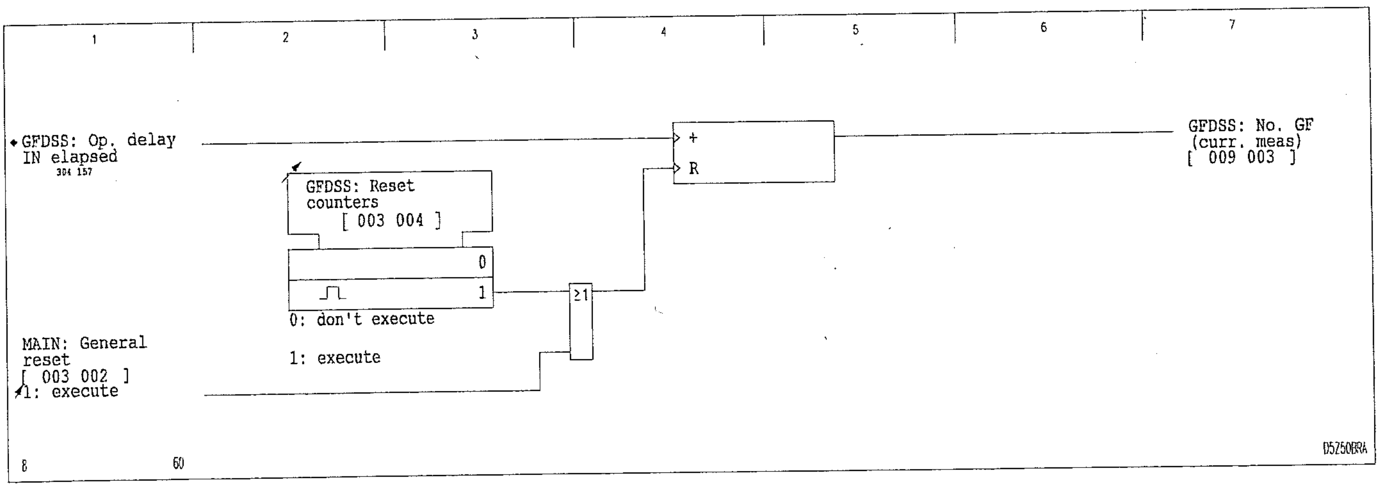
The frequency given by the setting f/f_{nom} is filtered from the residual current using Fourier analysis. Three periods are used for steady-state current evaluation. If the current exceeds the set threshold value, then a ground fault signal is issued after the set operate delay has elapsed.



3-145 *Evaluation of residual current*

Counting the ground faults

The number of ground faults is counted. The counter may be reset either individually or together with the other counters.

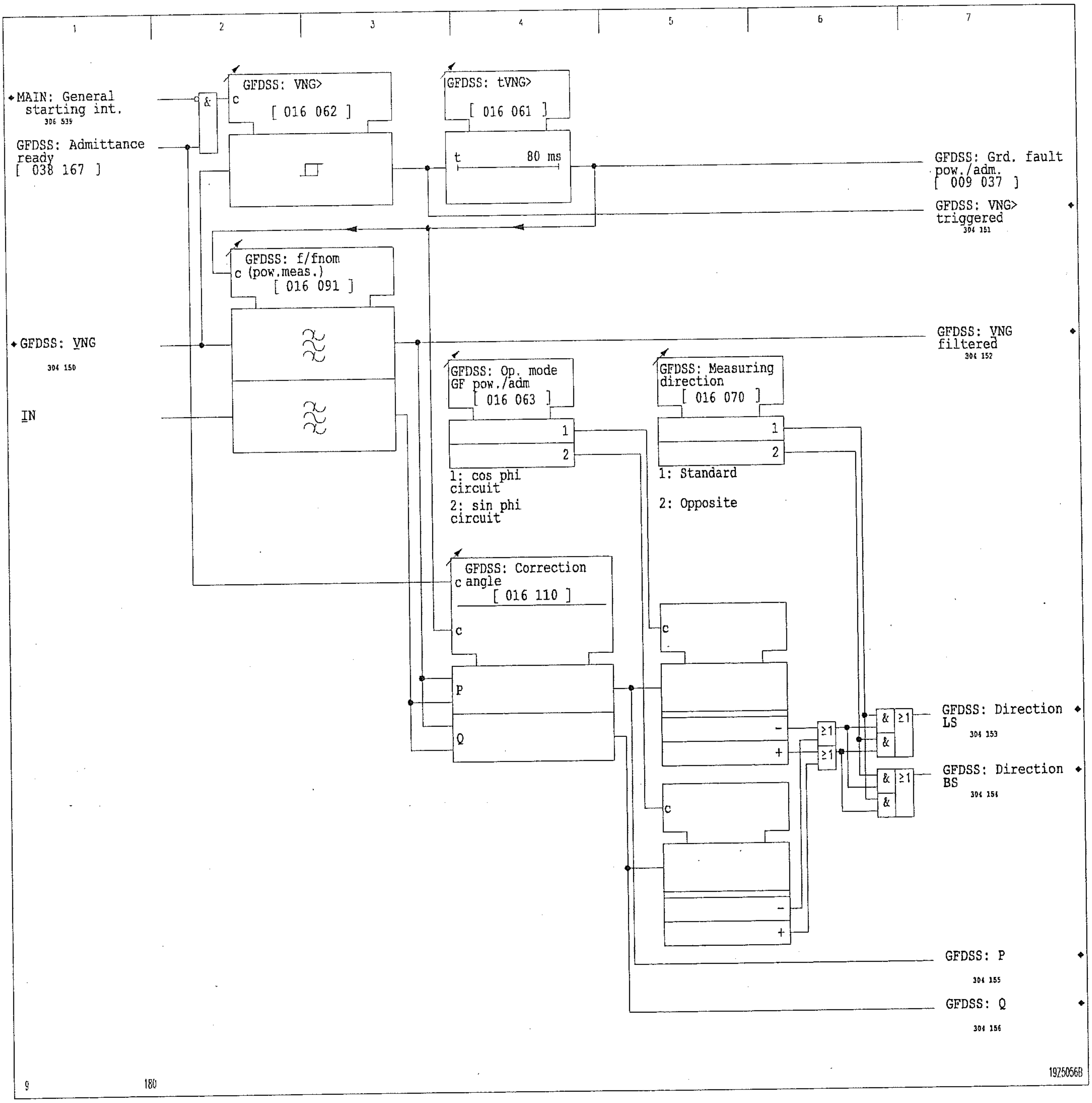


3-146 *Counting the ground faults*

3.27.3 Admittance Evaluation

In order to detect the ground fault direction, ground fault direction determination in the admittance evaluation mode requires the neutral-point displacement voltage and the residual current. The frequency given by the setting f/f_{nom} is filtered from these quantities using Fourier analysis.

Measurement is enabled after timer stage tVNG> has elapsed; this stage is started by the trigger VNG>. The sign of either active power GFDSS: Oper. mode GF (pow.) *'cos phi circuit'* or reactive power GFDSS: Oper. mode GF (pow.) *'sin phi circuit'* is used for direction determination, depending on the operating mode selected – *cos phi circuit* or *sin phi circuit*. Connection of the measuring circuits is taken into account by the setting GFDSS: Measuring direction. With the standard connection, a decision for 'LS' is reached in the case of a ground fault on the line side and 'BS' in the case of a ground fault on the busbar side. The setting GFDSS: Correction angle is provided to compensate for phase-angle errors of the system transformers.

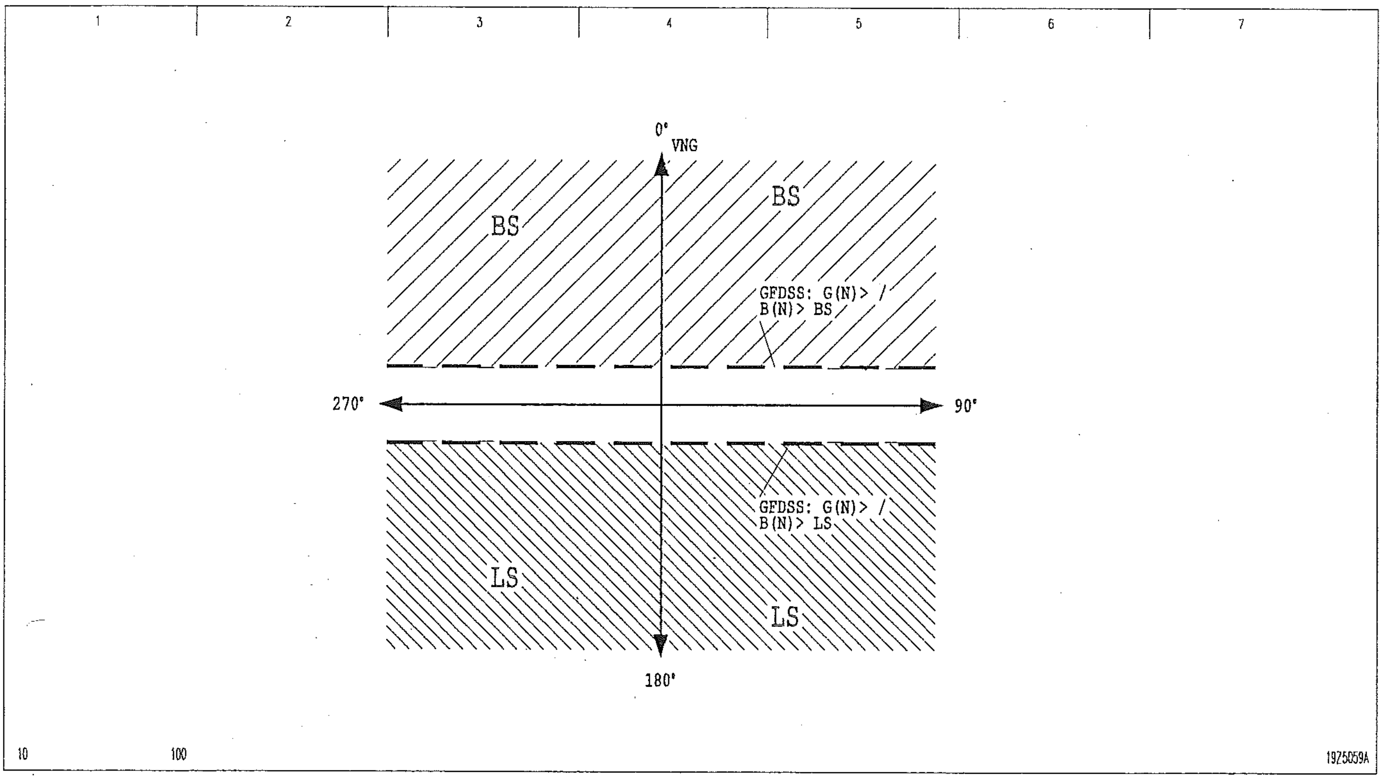


3-147 *Direction determination in the admittance evaluation mode* *cos φ circuit*

The direction decision is enabled if the conductance G(N) in the residual current loop has exceeded the set threshold operate value. This setting makes it possible to achieve the characteristic shown in Figure 3-148.

Output of the direction decisions is operate- and release-delayed.

The trip signal of the GFDSS function for the forward direction is blocked by the auto-reclosing control function (ARC) if the ARC is able to form a trip command.

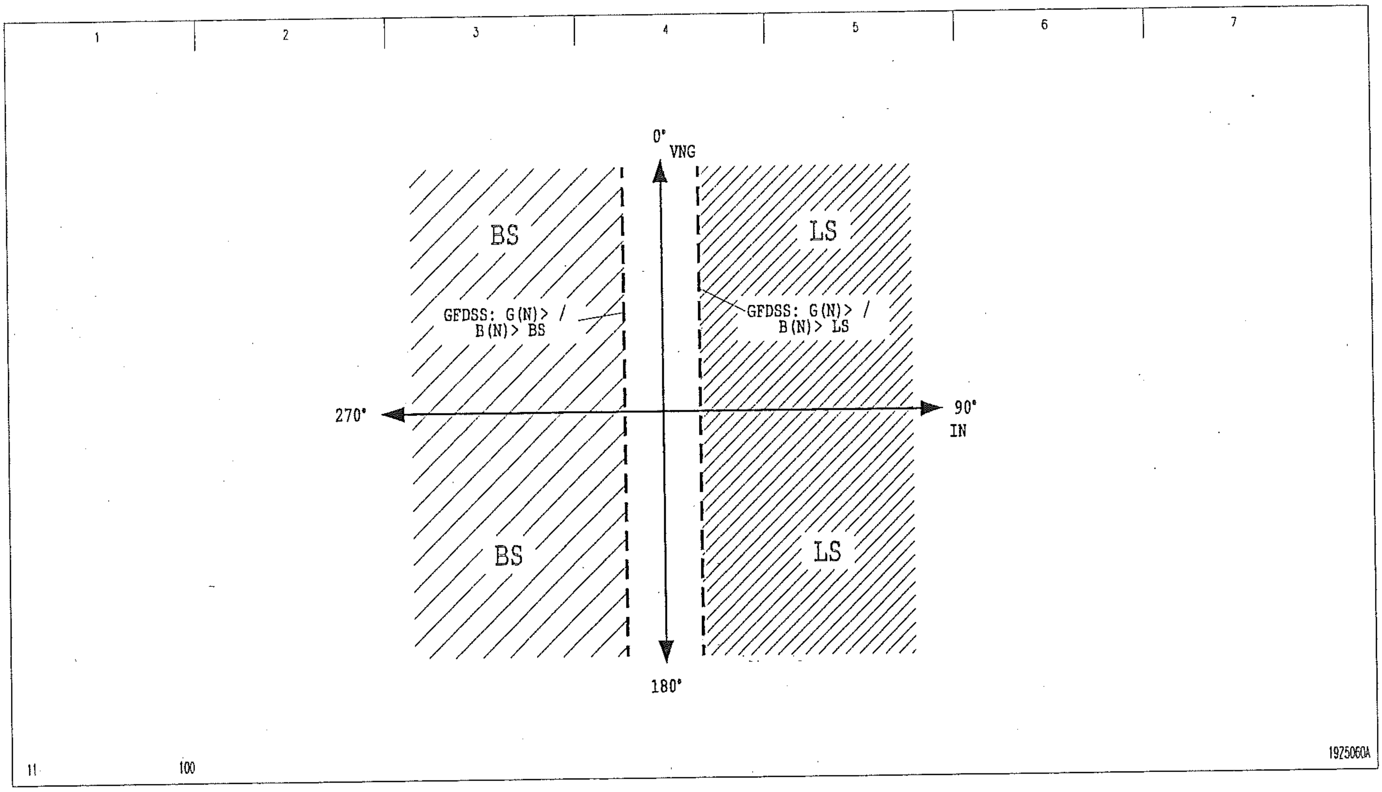


3-148 Characteristic of ground fault direction determination by steady-state admittance evaluation, operating mode cos φ *sin φ circuit*

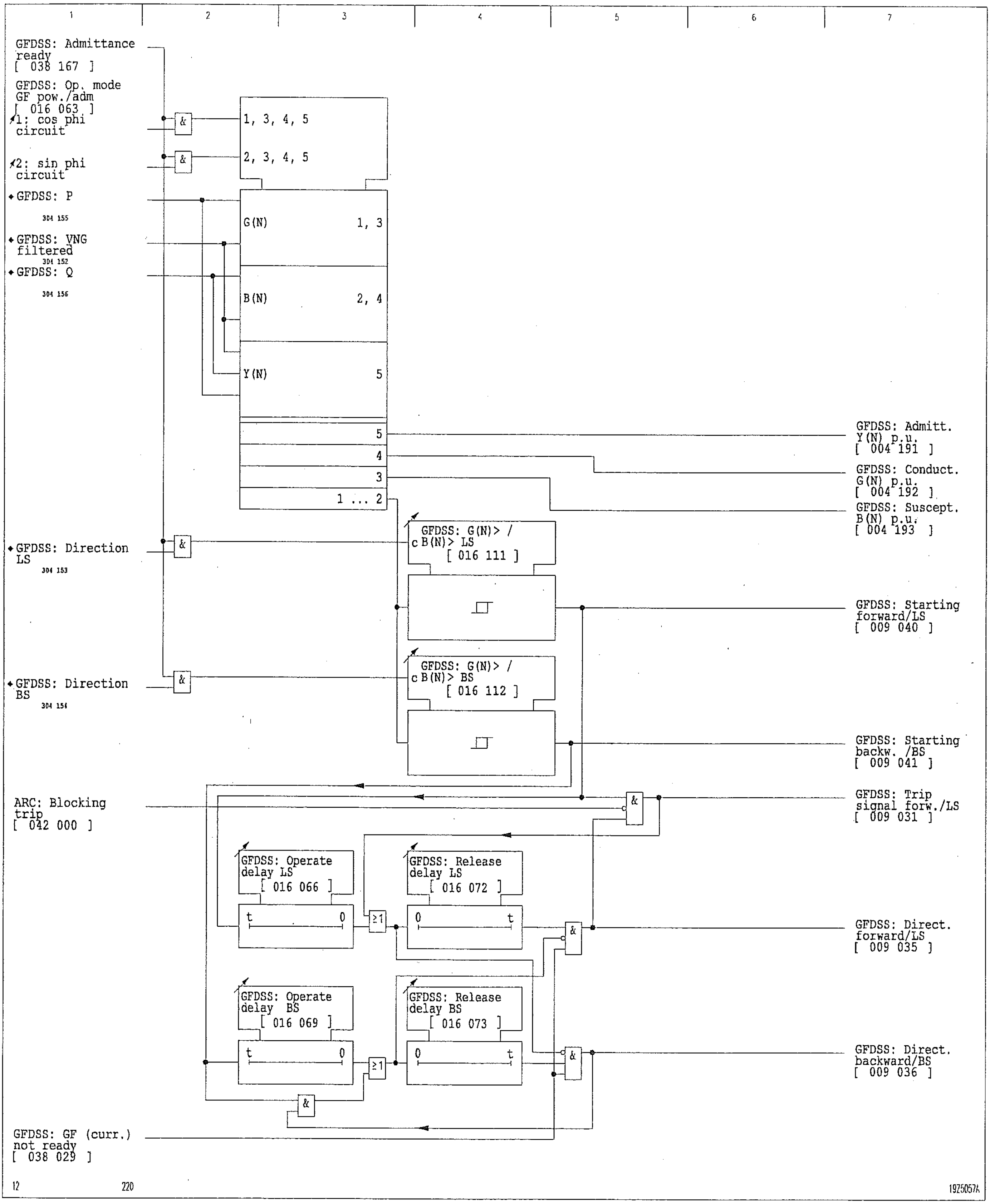
The direction decision is enabled if the susceptance B(N) in the residual current loop has exceeded the set threshold operate value. This setting makes it possible to achieve the characteristic shown in Figure 3-149.

Output of the direction decisions is operate- and release-delayed.

The trip signal of the GFDSS function for the forward direction is blocked by the auto-reclosing control function (ARC) if the ARC is able to form a trip command.



3-149 *Characteristic of ground fault direction determination by steady-state admittance evaluation, operating mode sin φ*



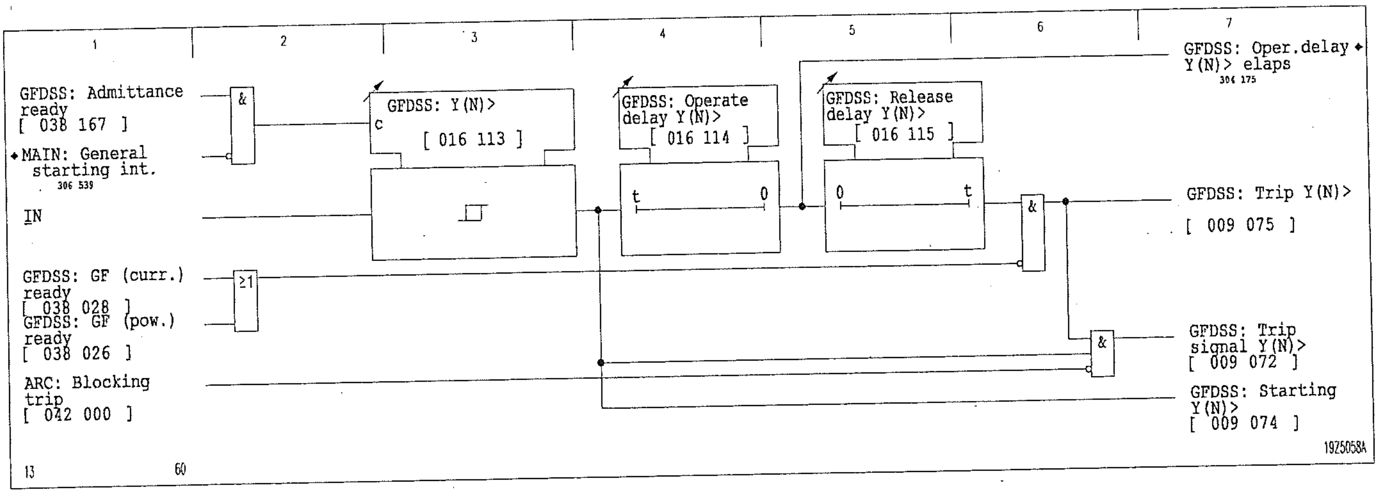
3-150 Output of the direction decisions in the admittance evaluation mode

Non-directional ground fault determination

In the admittance evaluation mode, the non-directional ground fault determination function can serve as backup protection in case, for example, the active component G(E) is too small for directional determination.

The admittance in the residual current loop is used in the evaluation. If the current exceeds the set threshold value, then a ground fault signal is issued after the set operate delay has elapsed.

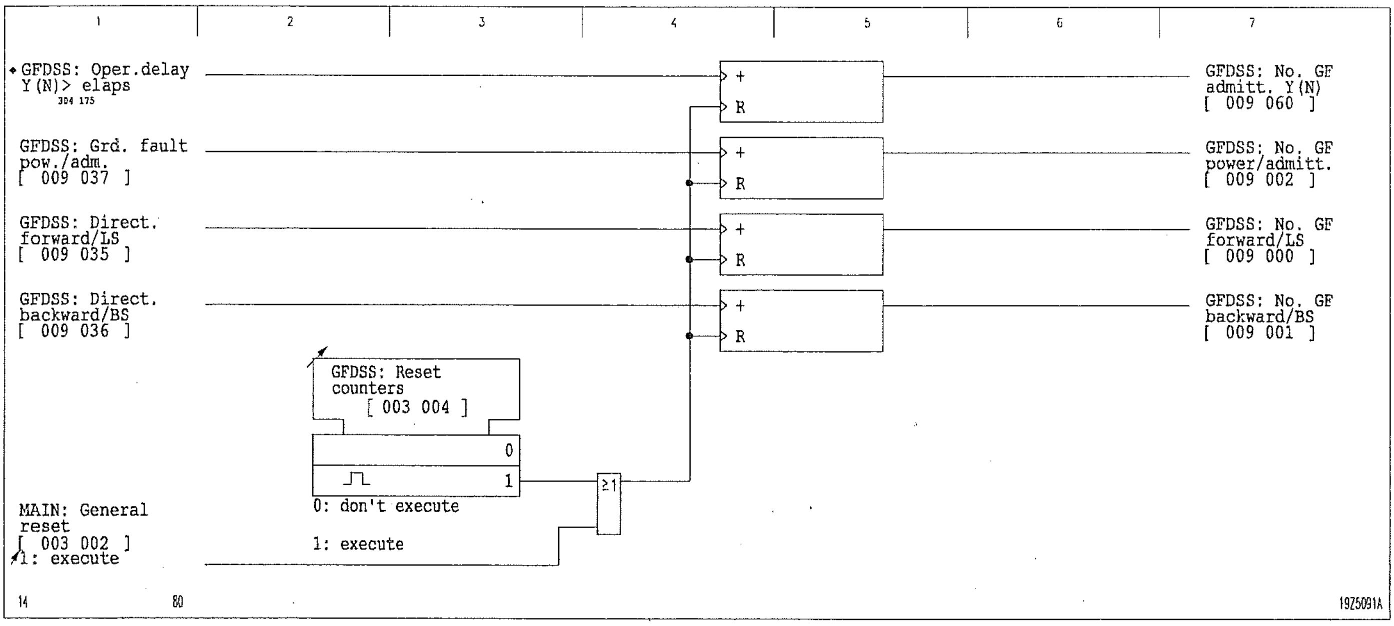
The trip signal of the non-directional ground fault determination is blocked by the auto-reclosing control function (ARC) if the ARC is able to form a trip command.



3-151 *Admittance evaluation*

3.27.4 Counting the Ground Faults Detected by Steady-State Power and Admittance Evaluation

The number of ground faults and direction decisions is counted. The counters can be reset either individually or as a group.



3-152 Counting the ground faults

3.28 Motor Protection (Function Group MP)

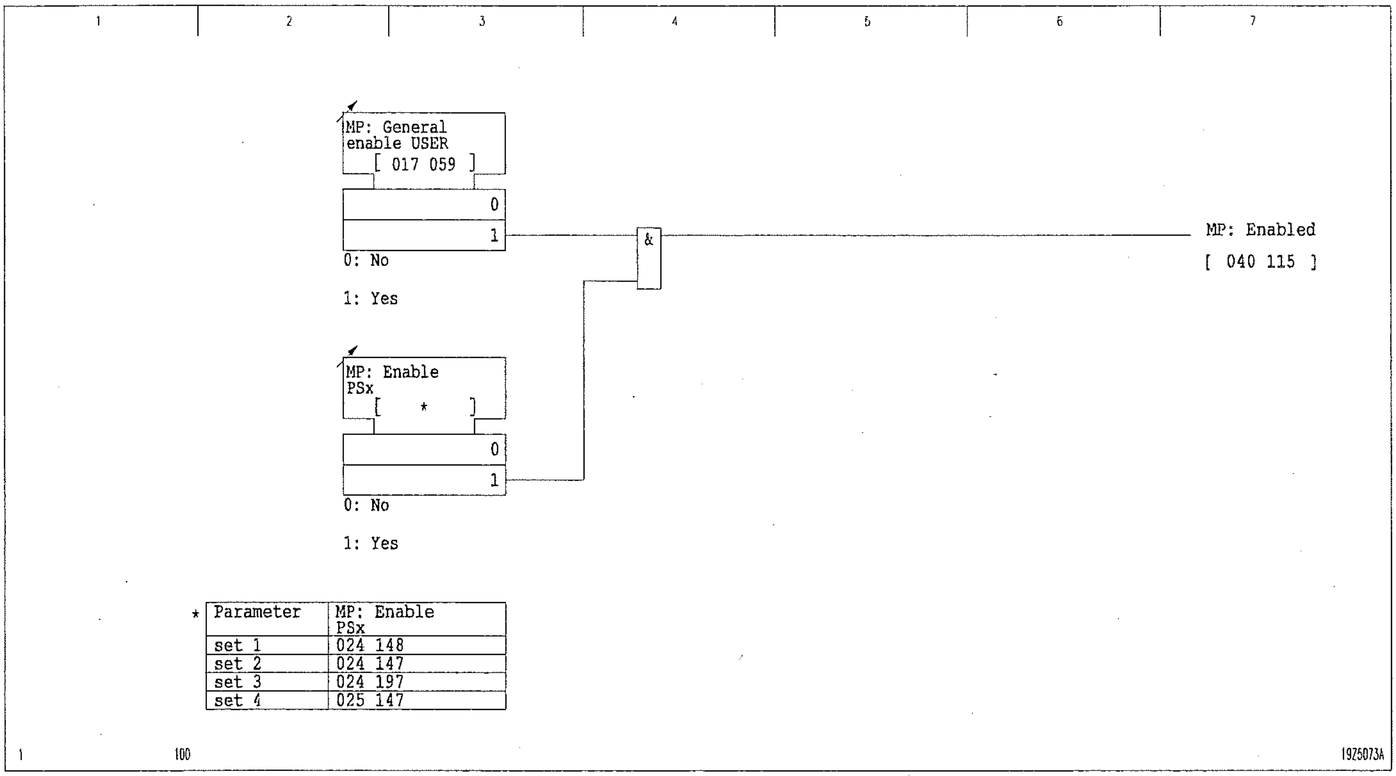
A motor protection function is implemented in the P130C. This motor protection function is designed especially for protection of directly switched, high-voltage asynchronous motors with thermally critical rotors. Optimized protection functions are available for this application:

- Overload protection with thermal replica of the motor (complete memory)
- Inclusion of heat dispersion processes in the rotor after several startups
- Separate cooling time constants for running and stopped machines
- Startup frequency monitoring for the number of startups, restart blocking
- Heavy starting logic
- Locked rotor protection
- Logic function for the operating mode with thermal overload protection (THERM)
- Special startup measured values for commissioning

The definite-time overcurrent protection stages and the unbalance protection function, which are necessary for comprehensive motor protection, are described in this chapter in the sections on DTOC protection and unbalance protection (I2>), respectively.

Enabling or disabling motor protection

Limit value monitoring can be disabled or enabled from the local control panel. Moreover, enabling can be carried out separately for each parameter set.

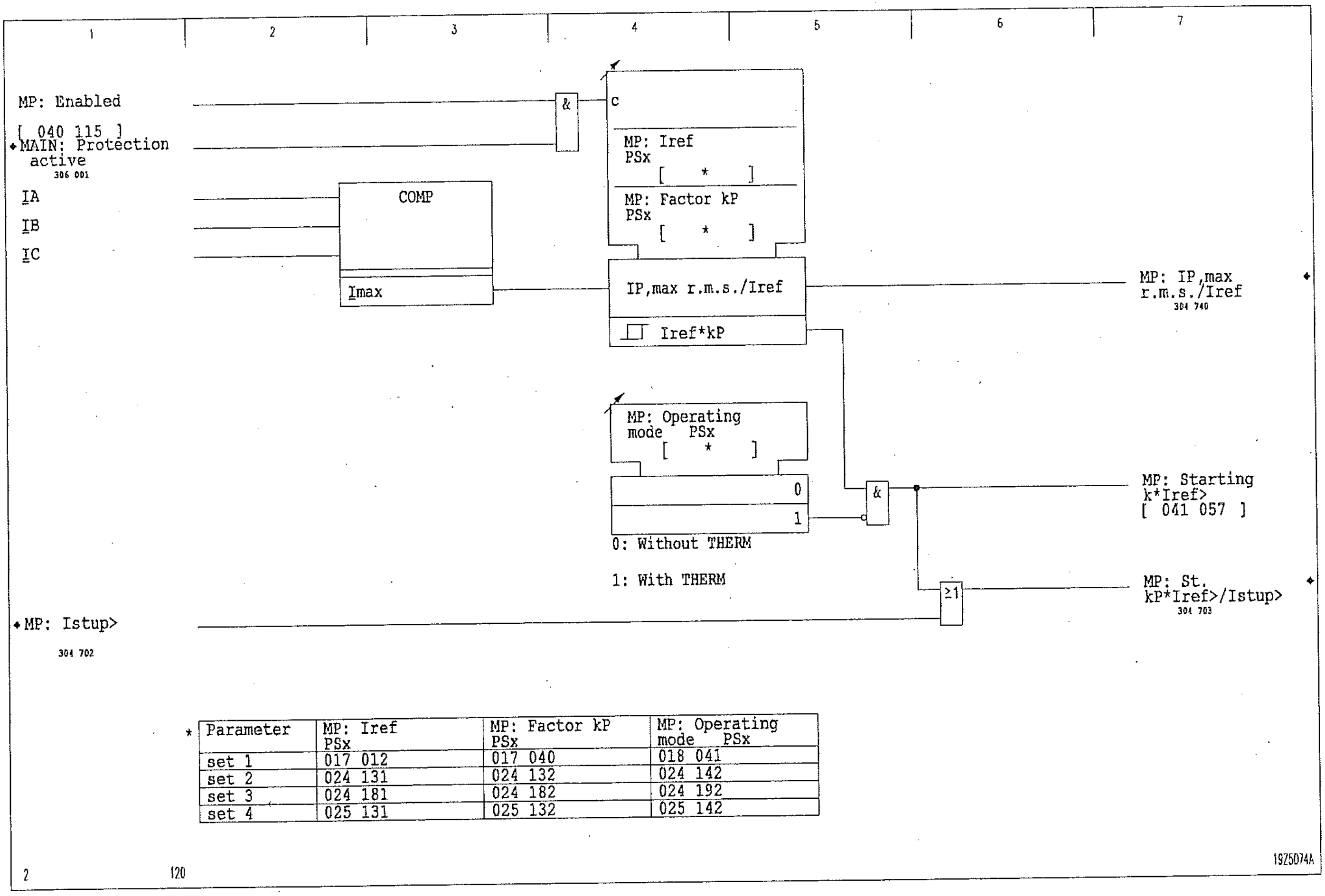


3-153 Enabling or disabling motor protection

Starting conditions

The overcurrent stage $I_{kIref,P}$> serves as the starting stage for the overload protection function. The maximum value of the three phase currents is evaluated. The reference quantity for operate value and tripping time is the set reference current $I_{ref,P}$. The current stage operates when $I_{kIref,P}$> is exceeded.

The output signal of the overcurrent stage $I_{kIref,P}$> is the starting signal.



Parameter	MP: Iref PSx	MP: Factor kP PSx	MP: Operating mode PSx
set 1	017 012	017 040	018 041
set 2	024 131	024 132	024 142
set 3	024 181	024 182	024 192
set 4	025 131	025 132	025 142

3-154 *Starting conditions*

3.28.1 Overload Protection

Recognition of operating state

In order to control the overload protection function, i.e., for optimized thermal tracking, the P130C is equipped with an operating state recognition function. The possible operating states of a directly switched asynchronous motor are detected by way of different trigger stages, as follows:

- ☐ Machine stopped:
  If the measured maximum r.m.s. phase current falls below the current threshold of 0.1 I_{ref}, the 'machine stopped' state is recognized. No-load currents of asynchronous motors will definitely be above the current threshold of 0.1 I_{ref}.
- ☐ Machine running:
  If the measured maximum r.m.s. phase current is above the current threshold of 0.1 I_{ref}, the 'machine running' state is recognized.
- ☐ Overload range:
  The overload range of a machine includes all those currents that exceed the maximum permissible continuous thermal current of the machine. If the measured maximum r.m.s. phase current exceeds the current threshold of $I_{kIref,P}$>, then an increment is added to the overload memory.
- ☐ Startup:
  The onset of startup in a directly switched asynchronous motor is detected when the measured maximum r.m.s. phase current exceeds the current threshold of MP: IStUp> PSx for a set minimum period $t_{IStUp>}$. The end of a startup process is detected when, after onset of startup has been identified, the measured maximum r.m.s. phase current falls below the current threshold of 0.6 I_{StUp}>.

Overload memory

The thermal overload protection function implemented in the P130C is designed especially for protection of motors with thermally critical rotors, a very common motor type. A special overload memory is included for this application. This memory contains a replica of the excess temperature of the protected object relative to the temperature of the coolant over a range of 0 to 100 %. The following memory loading values have a particular significance in conjunction with this model:

- ☐ 0 %:
  A value of 0 % represents the cold state of the protected object, i.e., after the protected object has cooled down to ambient temperature.
- ☐ 20 %:
  A value of 20 % represents the minimum load of the overload memory with the protected object at operating temperature or after initial startup. A running machine is always considered as being at operating temperature.
- ☐ 40 %:
  A value of 40 % temporarily represents the minimum load of the overload memory after two consecutive startups of the protected object.
- ☐ 60 %:
  A value of 60 % temporarily represents the minimum load of the overload memory after three consecutive startups of the protected object.

- 100 %:
  As soon as the overload memory reaches a value of 100 % (trip threshold), an overload protection trip is issued. The hysteresis for a defined release of the trip signal is 1 %.

The overload memory mapping process that results in a replica of the actual thermal conditions in the protected object includes the following operations:

- Mapping of heating:
  The overload memory increases continuously by increments if the measured maximum r.m.s. phase current exceeds the current threshold of $I_{klref,P}$> (overload range). The rate of this increase is a function of the magnitude of the maximum r.m.s. phase current and, to some extent, of the selected tripping characteristic `MP: Character. type P PSx`.

- Mapping of heat transfer:
  If a startup has been detected and the maximum r.m.s. phase current falls below the current threshold of $0.6 \cdot I_{StUp}$>, then a continuous pre-discharge of the overload memory will automatically occur, governed by the time constant `MP: Tau after st.-up PSx` of the overload memory. This time constant is used to map the heat transfer in the asynchronous motor from the copper of the rotor to the rotor core. This continuous pre-discharge is linear until the minimum load after startup (described above) is reached, which is a function of the count on the startup frequency counter. The rate of this pre-discharge is constant: 40 % discharge ($\tau_{after\ startup}$ = 20) within a time period of 60 s, for example.

- Mapping of cooling:
  If the measured maximum r.m.s. phase current falls below the current threshold of $I_{klref,P}$> and if the mapping of heat transfer, if applicable, has been completed, then cooling of the protected object is simulated by continuous overload memory discharge. If the machine is running, the discharge will be governed by the cooling time constant `MP: Tau mach. running PSx` and will continue until the minimum loading state of 20 % is reached. If the machine is stopped, discharge will be governed by the constant `MP: Tau mach. stopped PSx` and will continue until the minimum loading state of 0 % is reached. Discharge is an exponential function of time. The cooling time from an initial value m_0 to an interim value of m(t) can be determined as follows:

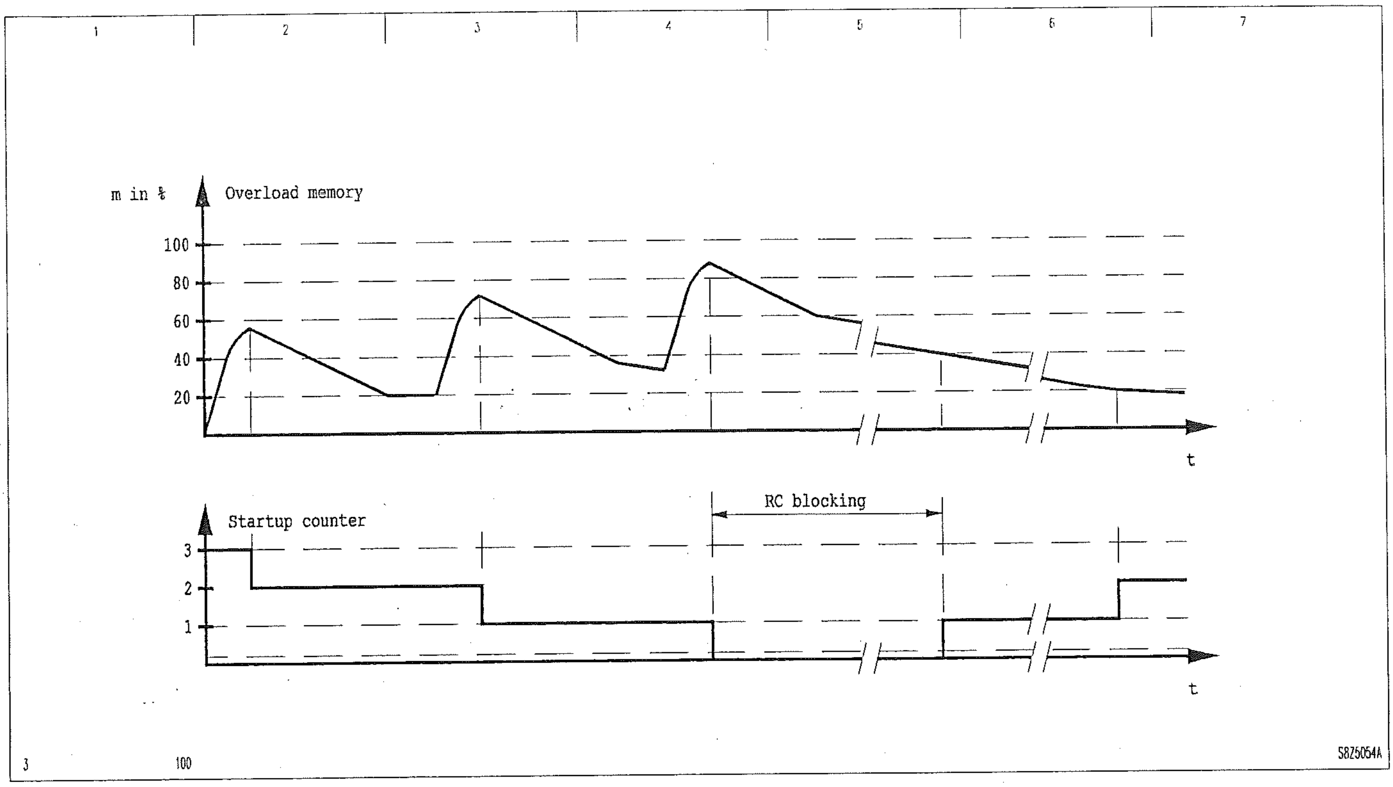
  - Machine running: $t = \tau_{machine.running} \cdot \ln \frac{m_0 - 0{,}2}{m(t) - 0{,}2}$

  - Machine stopped: $t = \tau_{machine.stopped} \cdot \ln \frac{m_0}{m(t)}$

Startup frequency monitoring

A startup counter in 'count down' circuit configuration is included in the P130C for startup frequency monitoring. Depending on the setting MP: Perm. No. st.-ups PSx, the permissible number of consecutive startups is either 'three from cold or two from warm' or 'two from cold or one from warm'. The counter reading at any given time indicates the number of consecutive startups that are still permitted. The startup counter is controlled as follows (see Figure 3-155):

- ☐ Decrementing the startup counter (number of startups still permitted):
  As the end of a startup is detected, the startup counter is decremented by '1'. If the counter reading reaches its minimum value of '0,' then the 'RC blocking' signal is formed and can - and indeed should - be configured to an output relay for the purpose of CB closure blocking.
- ☐ Incrementing the startup counter (number of startups still permitted)
  If the setting for the permissible number of consecutive startups is 'three from cold or two from warm' and the machine is running, then the startup counter is incremented by '1' if the overload memory charge drops below a threshold value of 40 % or 22 %, respectively, in conjunction with simulation of the cooling of the protected object. If the machine is stopped then the startup counter will be incremented by '1' if the overload memory charge drops below 40 %, 20 % or 2 %, respectively, as cooling of the protected object is simulated by the model.
  If the setting for the maximum permissible number of consecutive startups is 'two from cold or one from warm' and the machine is running, then the startup counter will be incremented by the value '1' if the overload memory charge drops below the threshold of 22 % as cooling of the protected object is simulated by the model. If the machine is stopped then the startup counter will be incremented by '1' if the overload memory charge drops below 20 % or 2 %, respectively, in conjunction with simulation of protected object cooling.
  The 'RC blocking' signal is withdrawn if the overload memory charge falls below the 40 % threshold (for three consecutive startups from cold or two from warm) or 22 % (for 'two from cold or one from warm').



3-155 *Overload memory and startup counter*

Heavy starting logic

The heavy starting application involves a situation in which a machine's startup time tStUp exceeds its maximum possible blocking time t_E from operating temperature. For this application the P130C is equipped with a special logic function that can be activated by the following two settings:

- ☐ The permissible number of consecutive startups is limited to 'two from cold or one from warm' (MP: Perm. No. st.-ups PSx).
- ☐ For the permissible startup time t_{StUp} (MP: St.-up time tStUp PSx), a higher value is set than for the maximum permissible blocking time t_E from operating temperature (MP: Blocking time tE PSx). These two setting values are only relevant for this particular application; if both settings are identical, they have no effect on the protective function and the heavy starting logic is not active.

If this logic function has been activated, then the two timer stages t_E and t_{StUp} are started at the time when the onset of a startup is detected, corrected by the discrimination time $t_{IStUp>}$. Once the set time t_E has elapsed, the logic function checks to see whether the machine is actually running. The presence of an external signal – from an overspeed monitor, for example – serves as the criterion for a running machine.

If a running machine is detected once the set time t_E has elapsed, then the overload memory charge is automatically frozen and tracking is only restarted after the set startup time t_{StUp} has elapsed. If a locked rotor state is detected after the set time t_E has elapsed, the overload memory is automatically set to a value of 100 %, which leads to an immediate trip decision.

Tripping time characteristics

The P130C user can choose between the following two tripping time characteristics:

- ☐ Reciprocally squared $t = (1 - m_0) \cdot t_{6I_{ref}} \cdot \frac{36}{(I/I_{ref})^2}$

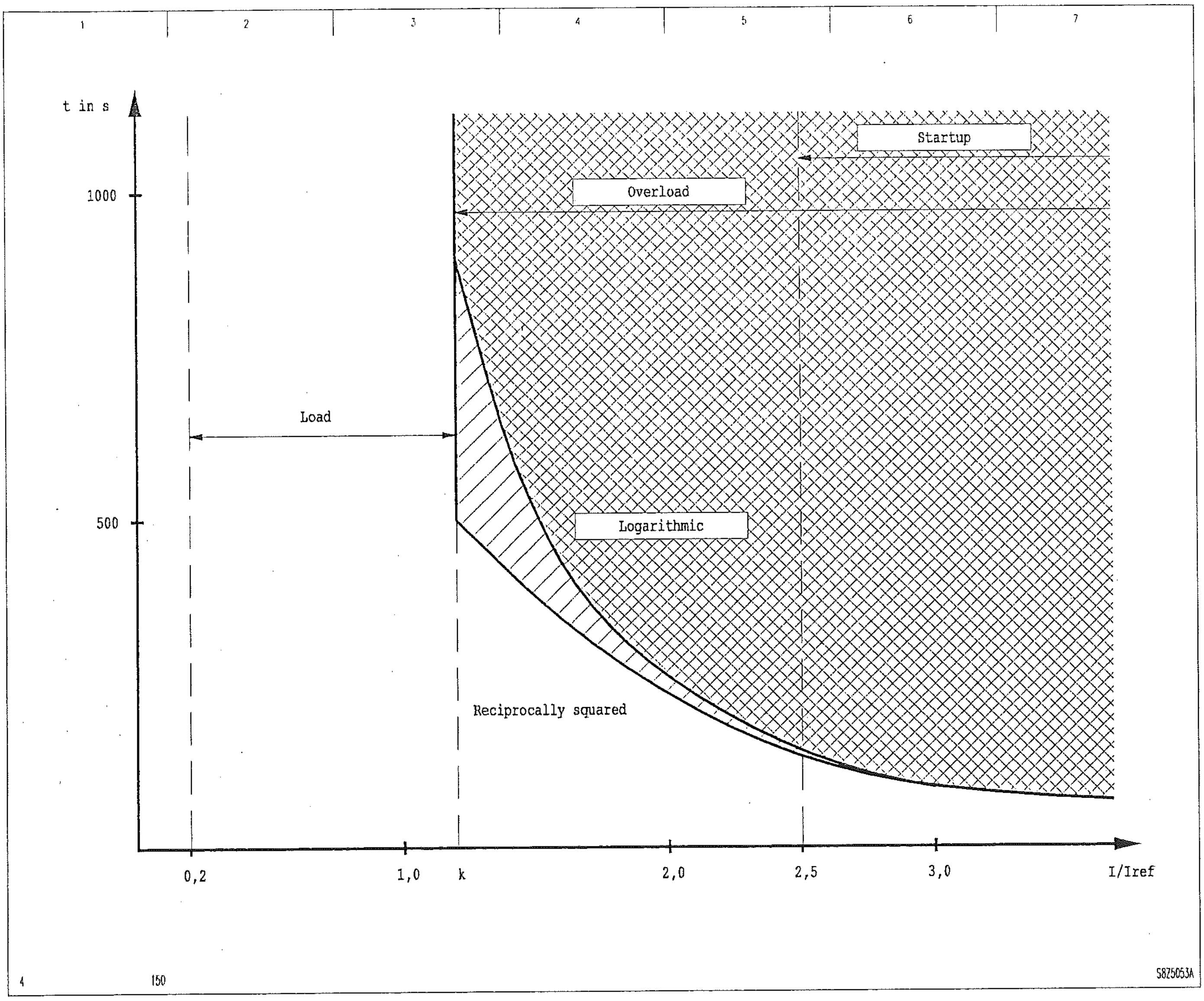
- ☐ Logarithmic: $t = (1 - m_0) \cdot t_{6I_{ref}} \cdot 36 \cdot \ln \frac{(I/I_{ref})^2}{(I/I_{ref})^2 - 1}$

where m_0 in each case signifies the pre-charging of the overload memory at time t = 0. With reference to the basic physical model (two-body model), the logarithmic characteristic in the overload range also takes into account heat transfer to the coolant, but this heat transfer becomes less significant as the overcurrent increases. At $I = 6 \cdot I_{ref}$, for example, the tripping time increase is only about 1.4 % and is thus below the specified accuracy of the protection device. In the low overcurrent range, selection of the logarithmic characteristic guarantees significantly higher tripping times than selection of the reciprocally squared characteristic (see Figure 3-156) since in the overload range the reciprocally squared characteristic always disregards heat transfer to the cooling medium. The possibility of choosing between two different tripping time characteristics takes into account the fact that the user or the application may require a more restrictive or less restrictive type of protection. For currents in excess of 10 I_{ref}, the tripping times are limited in the direction of lower values.

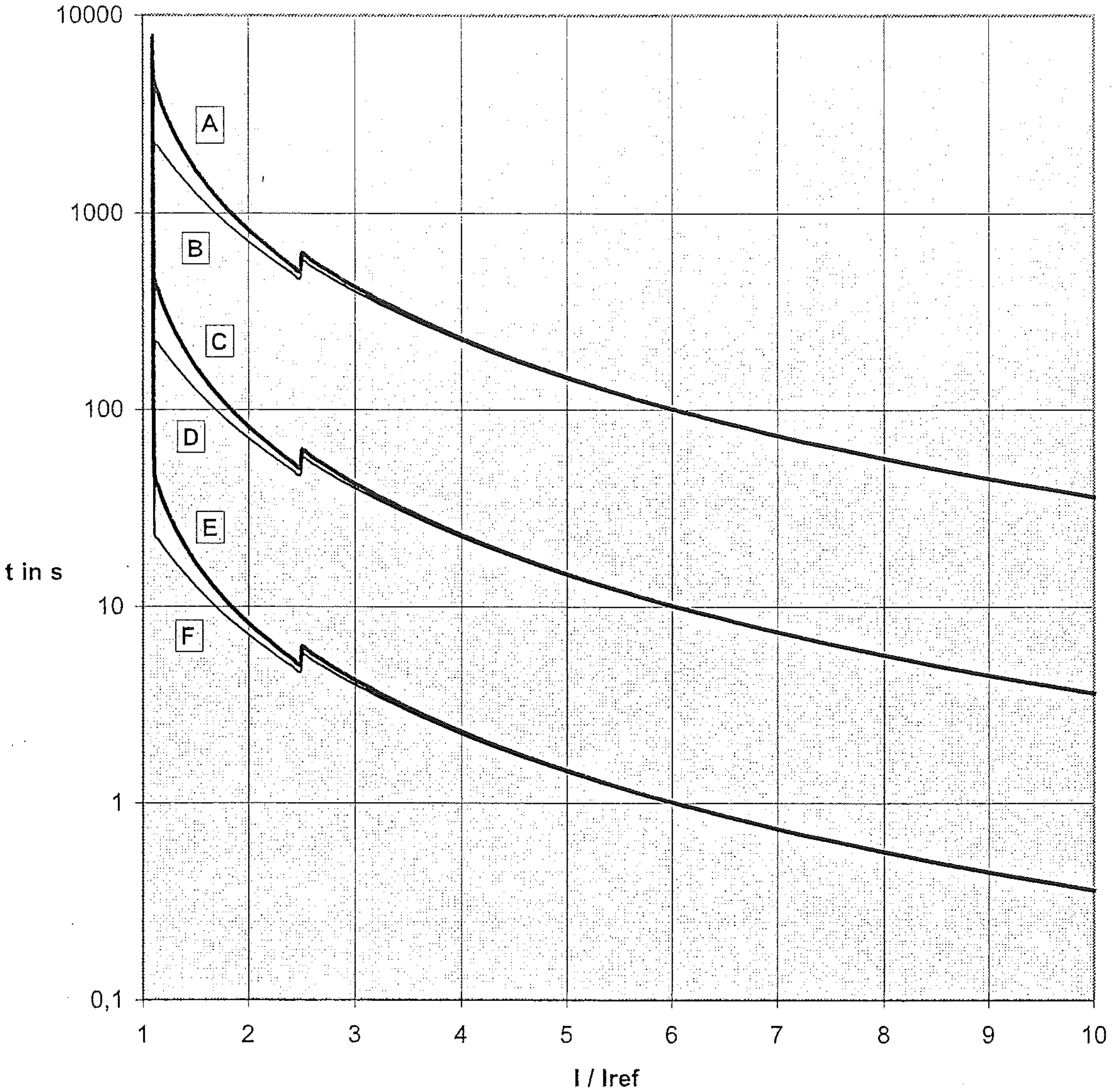
The equation for determining the setting value t_{6Iref} can be derived from the above equations for tripping time t. For this purpose the startup current $I_{startup}$ and the maximum permissible blocking time from cold $t_{block,cold}$ for the asynchronous motor must be known. Setting the overload protection function on the basis of the 'cold' tripping time where m_0 = 0 % ('cold curve') is permitted since the conditions for a machine at operating temperature are automatically taken into account. The conditional equations for the setting value t_{6Iref} are therefore the following:

- ☐ For the reciprocally squared characteristic we set: $t_{6I_B} = t_{block,cold} \cdot \frac{(I_{startup}/I_{ref})^2}{36}$

- ☐ For the logarithmic characteristic we set: $t_{6I_B} = t_{block,cold} \cdot \frac{1}{36 \cdot \ln \frac{(I_{startup}/I_{ref})^2}{(I_{startup}/I_{ref})^2 - 1}}$



3-156 *Tripping time characteristics*



A = logarithmic characteristic (at t6Iref=100s)

B = reciprocally squared characteristic (at t6Iref=100s)

C = logarithmic characteristic (at t6Iref=10s)

D = reciprocally squared characteristic (at t6Iref=10s)

E = logarithmic characteristic (at t6Iref=1s)

F = reciprocally squared characteristic (at t6Iref=1s)

S8Z50D6A

3-157 Tripping characteristic of motor protection (at I/Iref ≤ 2.5 we have m=0.2, at I/Iref > 2.5 we have m=0)

Plausibility conditions

A number of plausibility conditions need to be observed in order to ensure that the protected object is given optimum protection and that unintended tripping is prevented.

- ☐ If the permissible number of consecutive startups is set for the sequence 'three from cold or two from warm' and if this set permissible number of consecutive startups is also intended to be used up during operation, then the heating during startup in the overload memory (OL_DA: Heat. dur. start-up) must not exceed 60 %. If the calculation is based on a constant startup current (OL_DA: Start-up current) over the entire startup period, then we obtain the plausibility condition $t_{startup} \leq 0.6 \cdot t_{block,cold}$. However, since the startup current decreases during the course of the startup time (OL_DA: Time taken f. startup), thereby causing rate of memory charging to decrease as well, one can therefore assume that there is a corresponding extra margin, for all practical purposes.
- ☐ The setting value for the overload protection function is determined on the basis of the stated maximum permissible blocking time from the cold state $t_{block,cold}$. However, when a machine at operating temperature is connected, a protective trip during the t_E period must be guaranteed. Therefore, it is always necessary to check the plausibility condition $t_{block,cold} \leq 1.25 \cdot t_E$ and make sure the condition is met.

Initialization or plausibility check of the thermal replica

Under the following conditions, the P130C will not be able to track the thermal replica of the protected object, and re-initialization of the thermal replica will be triggered :

- ☐ The power supply has been interrupted.
- ☐ Protection has been disabled.
- ☐ Motor protection has been disabled.

If the above conditions no longer apply, a plausibility check of the thermal replica is automatically performed prior to cyclic processing.

- ☐ Operation condition 'machine running' but not 'starting up':
  A cyclic plausibility check of the thermal replica is carried out such that if the overload memory's charge is below 20 % it is increased to the minimum value of 20 % (≡ machine at operating temperature).
- ☐ Operation condition 'machine starting up':
  Once the end of a startup is detected and the startup counter is decremented as a result, the charging state of the overload memory is increased, if appropriate, to the associated minimum value.

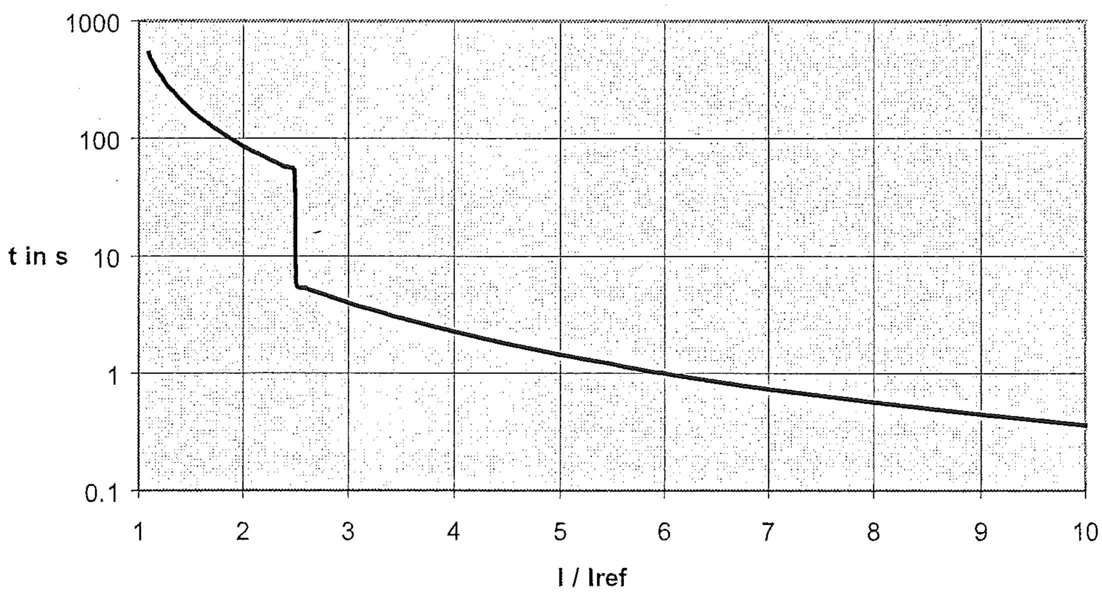
For each of the above procedures involving initialization or a plausibility check of the thermal replica, the charging stage of the overload memory is always coupled to the reading of the counter for 'number of startups still permitted' (MP: St-ups still permitt.) Therefore, if the overload memory is set automatically, the counter reading is also changed to a plausible value as a function of the protection setting.

3.28.2 Special Overload Protection Cases

Logic function for the operating mode with thermal overload protection (THERM)

For particular applications, the machine may be operated in the overload range for a longer period of time. In such cases the motor protection function (MP) is too restrictive. For these applications the MP and THERM protection functions are combined. The MP protection function then serves as rotor protection and the THERM protection function as stator protection.

If M P: Operating mode PSx is set to *With THERM*, the overload memory will be incremented when the maximum r.m.s. phase current is above the set current threshold current threshold M P: I_{StUp}> PSx. If this threshold is not exceeded, the memory contents after a startup will initially be decremented until the mapping of the heat transfer from the copper of the rotor to the rotor core is complete. Thereafter, the overload memory will maintain a constant load and the thermal model of the thermal overload protection function (THERM) will become active. With the onset of another startup of the asynchronous motor (not the first startup), the thermal model of the THERM protection function will be temporarily blocked during the startup time.



MP protection: set reciprocally squared characteristic, t6Iref = 1 s

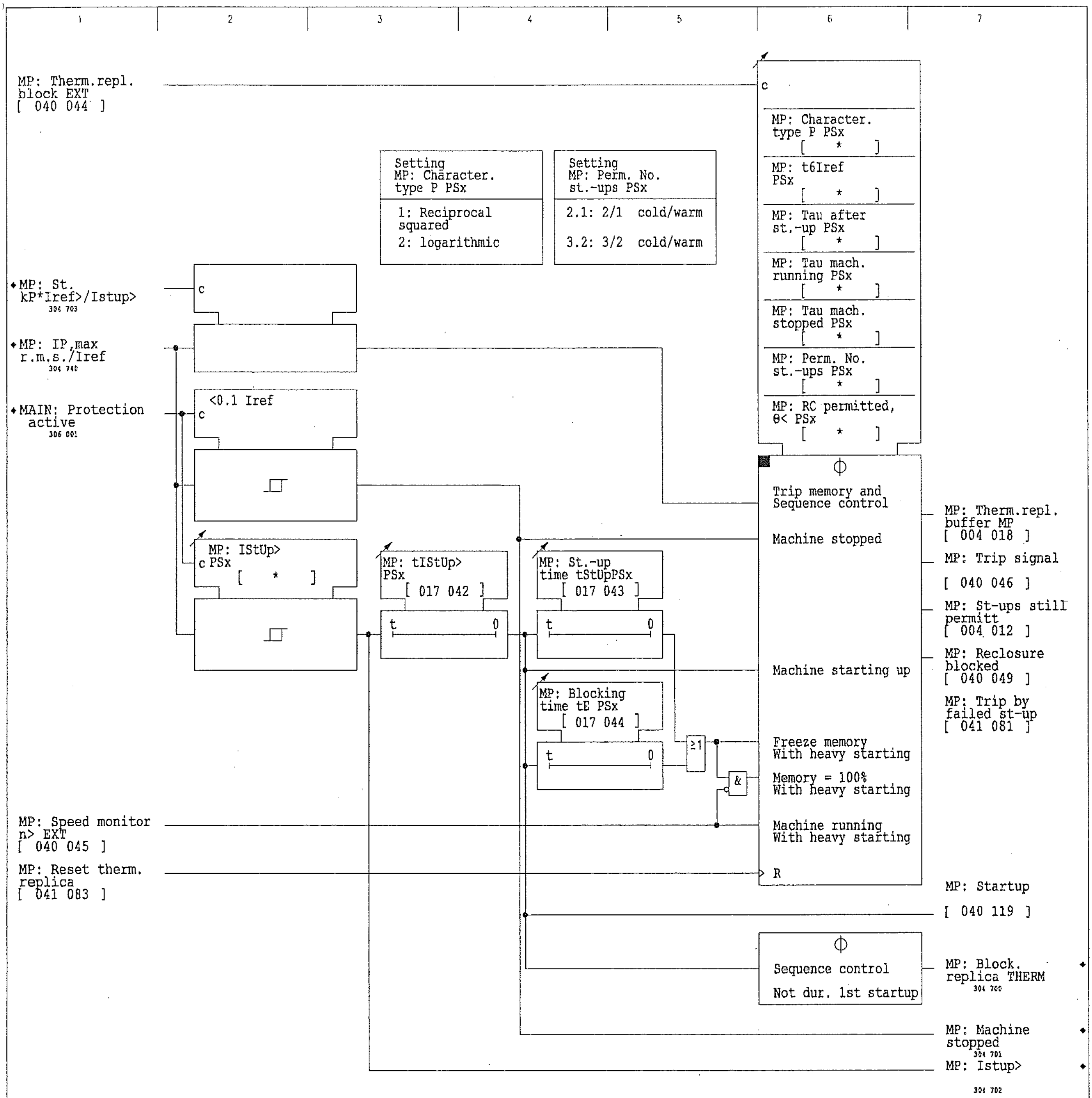
THERM protection: set time constant 1 = 300 s, trip limit value = 100 %

S8Z50F3A

3-158 Tripping characteristic of motor protection with operating mode 'With THERM' ('cold' characteristic)

Change of threshold for 'reclosure permitted"

Depending on the particular application, it is possible to change the overload memory threshold value assumed for general use, when simulating protected object cooling, to either 40 % (with 'three startups from cold or two from warm') or 22 % (with 'two startups from cold or one from warm'). This set threshold value MP: RC permitted, Θ< PSx can differ from these average values so as to be more or less restrictive.



* Parameter	MP: Character. type P PSx	MP: t6Iref PSx	MP: Tau after st.-up PSx	MP: Tau mach. running PSx	MP: Tau mach. stopped PSx	MP: Perm. No. st.-ups PSx
set 1	017 029	017 041	018 042	017 088	017 089	017 047
set 2	024 135	024 136	024 137	024 138	024 139	024 140
set 3	024 185	025 186	024 187	024 188	024 189	024 190
set 4	025 135	025 136	025 137	025 138	025 139	025 140

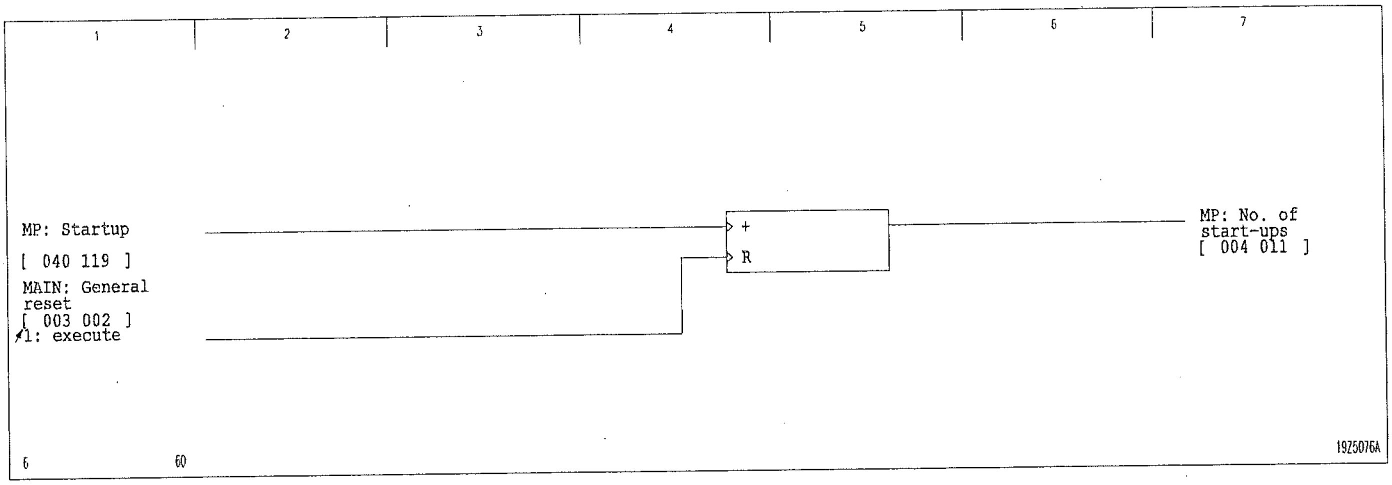
* Parameter	MP: RC permitted, θ< PSx	MP: IStUp> PSx	MP: tIStUp> PSx	MP: St.-up time tStUpPSx	MP: Blocking time tE PSx
set 1	018 043	017 053	017 042	017 043	017 044
set 2	024 141	024 133	024 134	024 143	024 144
set 3	024 191	024 183	024 184	024 193	024 194
set 4	025 141	025 133	025 134	025 143	025 144

5 220 19Z5075A

3-159 Overload protection in motor protection

Startup counter

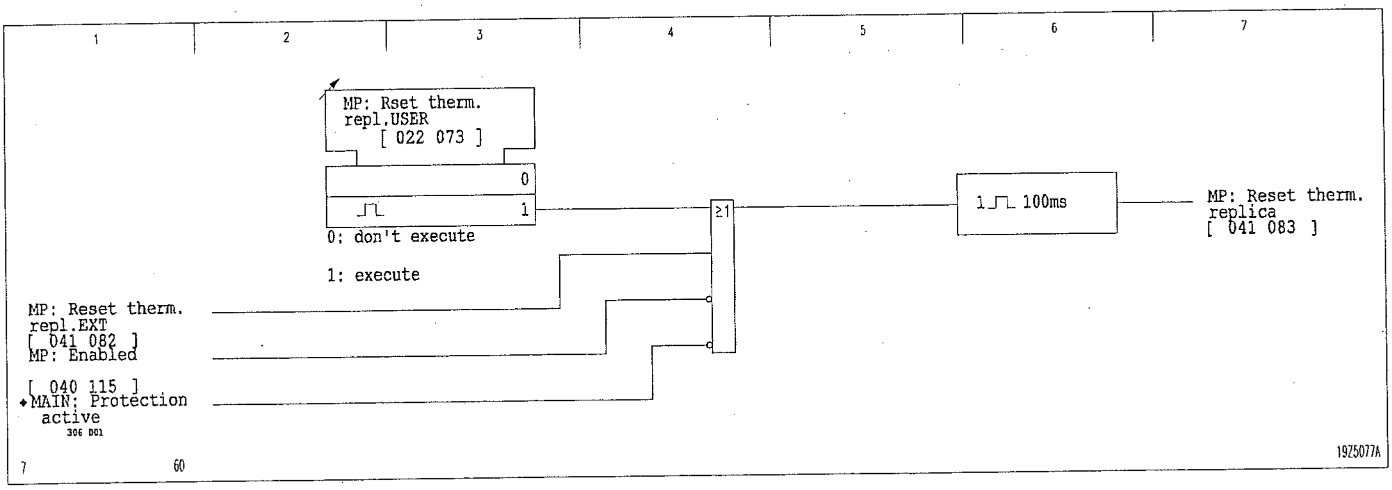
The motor startups are counted. The counter can be reset either individually or with others as a group.



3-160 *Startup counter*

Reset of the thermal replica

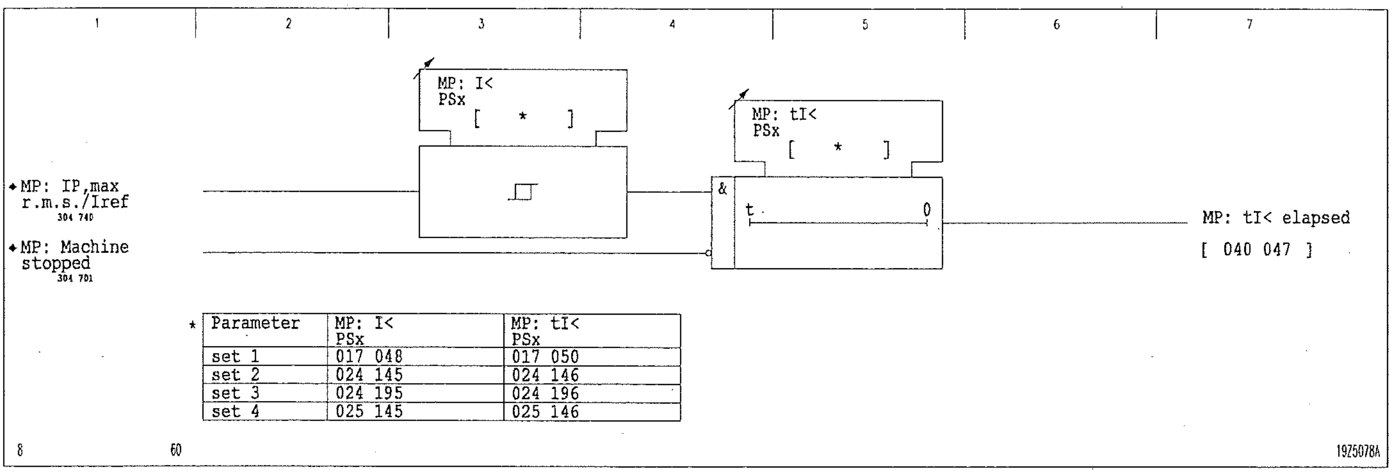
The thermal replica of motor heating can be reset at the local control panel or via a binary signal input that is configured accordingly.



3-161 *Reset of the thermal replica*

3.28.3 Low Load Protection

The low load protection function makes it possible to monitor the load torque of a motor drive for a minimum level. If the operating state recognition function detects a running machine and the maximum r.m.s. phase current falls below the set operate value for a set time, then an appropriate signal is generated. The signal needs to be configured to a separate output relay, since it cannot be linked directly to either the general starting signal or the trip command.



Parameter	MP: I< PSx	MP: tI< PSx
set 1	017 048	017 050
set 2	024 145	024 146
set 3	024 195	024 196
set 4	025 145	025 146

3-162 Overload protection in motor protection

3.28.4 Protection of Increased-Safety Machines

Motors that are operated in areas subject to explosion hazards must not reach a temperature in the case of overload or blocking that would be critical for the existing air-gas mixture.

The P130C is suitable for this type of application, which requires increased-safety protection (Type “e”), but the device must be installed outside the hazardous area.

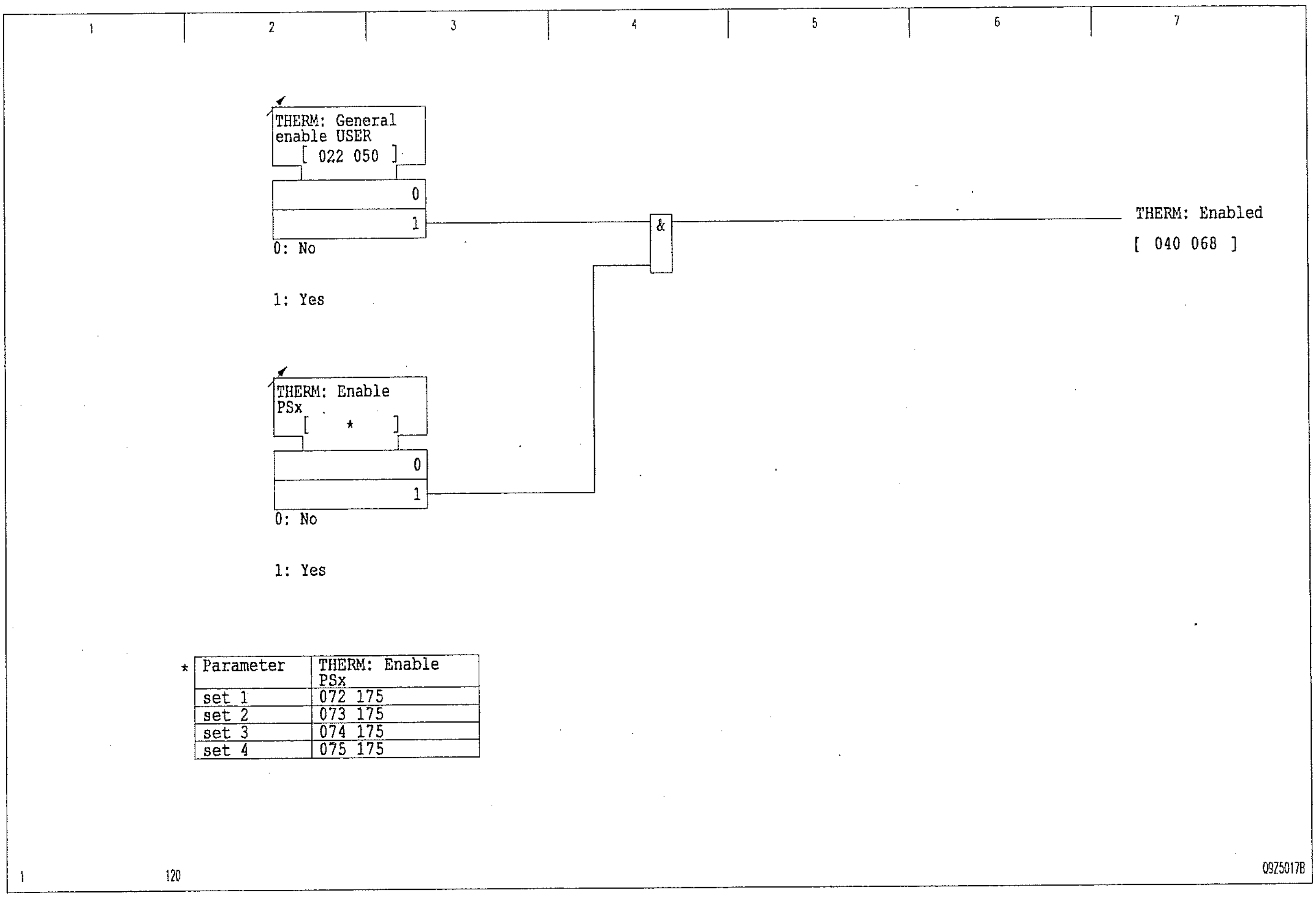
Please follow the setting instructions in Section 7.2: Protection of Increased-Safety Machines.

3.29 Thermal Overload Protection (Function Group THERM)

Using this function, thermal overload protection can be realized. The thermal overload protection function can be operated together with the motor protection function.

Disabling or enabling thermal overload protection

Thermal overload protection can be disabled or enabled from the local control panel. Moreover, enabling can be carried out separately for each parameter set.



3-163 Disabling or enabling thermal overload protection

Tripping characteristics

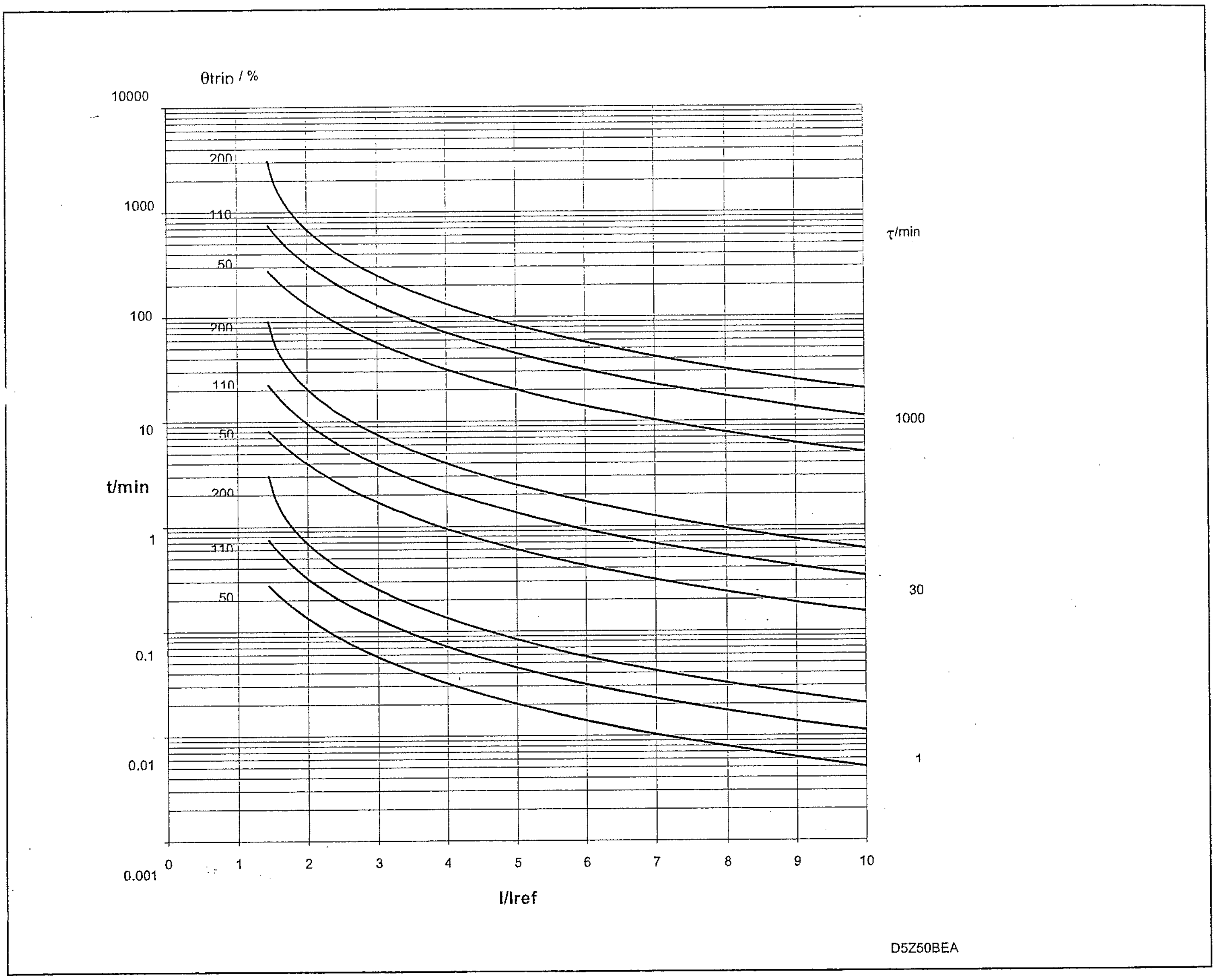
The maximum r.m.s. phase current is used to track a first-order thermal replica as specified in IEC 255-8. The following parameters will govern the tripping time:

- The set thermal time constant (τ) of the protected object THERM: Tim.const.1,>Ibl PSx.
- The set tripping level THERM: Rel. O/T trip PSx
- The accumulated thermal load Θ_P.
- The updated measured coolant temperature Θ_c for the protected object
- The maximum permissible coolant temperature $\Theta_{c,max}$ set at THERM: Max. cool. temp. PSx
- The maximum permissible object temperature Θ_{max}

$$t = \tau \cdot \ln \frac{\left(\frac{I}{I_{ref}}\right)^2 - \Theta_P}{\left(\frac{I}{I_{ref}}\right)^2 - \Theta_{trip} \cdot \left(1 - \frac{\Theta_c - \Theta_{c,max}}{\Theta_{max} - \Theta_{c,max}}\right)}$$

Figure 3-164 shows the tripping characteristics for $\Theta_P = 0$ % and with a measured coolant temperature Θ_c identical to the maximum permissible coolant temperature.

The setting for the operating mode selects an 'absolute' or 'relative' replica. If the setting is for *Absolute replica*, the P130C will operate with a fixed trip threshold Θ_{trip} of 100 %.



3-164 *Tripping characteristic of thermal overload protection (for Θ_P = 0 % and with a measured coolant temperature Θ_c identical to the maximum permissible coolant temperature)*

Coolant temperature

The P130C is not fitted with an analog I/O module Y. As a result, coolant temperature acquisition for the protected object is not possible. Instead, the setting THERM: Default CTA PSx is used in the calculation of the tripping time.

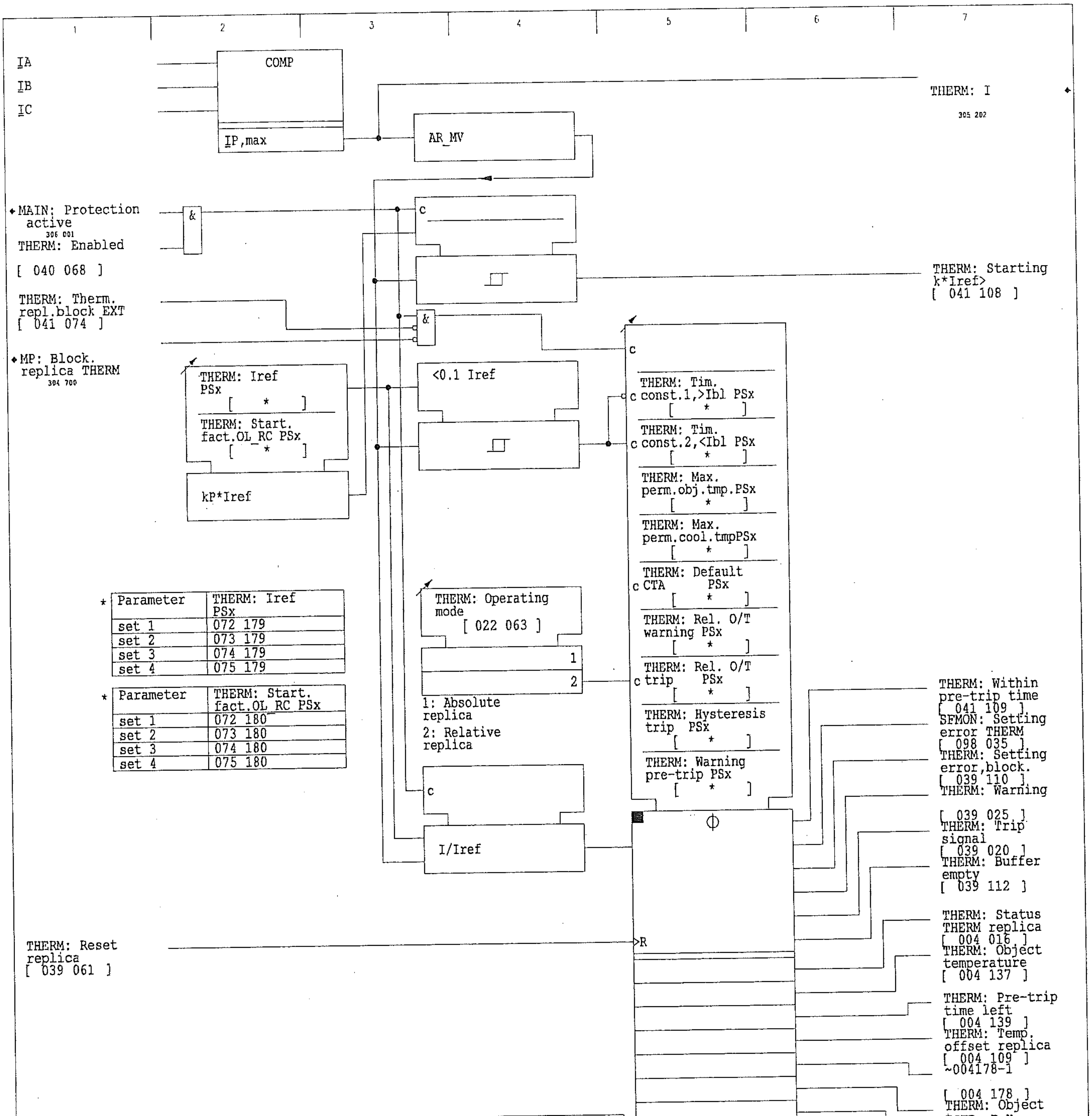
Warning

A warning signal can be set in accordance with the set operate value (THERM: Rel. O/T warning PSx). Moreover, a pre-trip time limit can be set. When the time left until tripping will occur falls below this pre-trip limit, a warning will be issued.

If the current falls below the default threshold of 0.1 I_{ref}, the buffer is discharged with the set time constant THERM: Tim.const.2,<Ibl PSx). The thermal replica may be reset either from the local control panel or via an appropriately configured binary signal input. Resetting is possible even when thermal overload protection is disabled. Thermal overload protection can be blocked via an appropriately configured binary signal input.

Operation together with the motor protection function

If the thermal overload protection function is being operated together with the motor protection function and if another startup of an asynchronous motor occurs (other than the first startup), then the thermal overload protection function will be temporarily blocked during the startup time.
If the motor protection function (MP) and the thermal overload protection function (THERM) are being used simultaneously, then MP protection will act on THERM protection rather than the other way around.



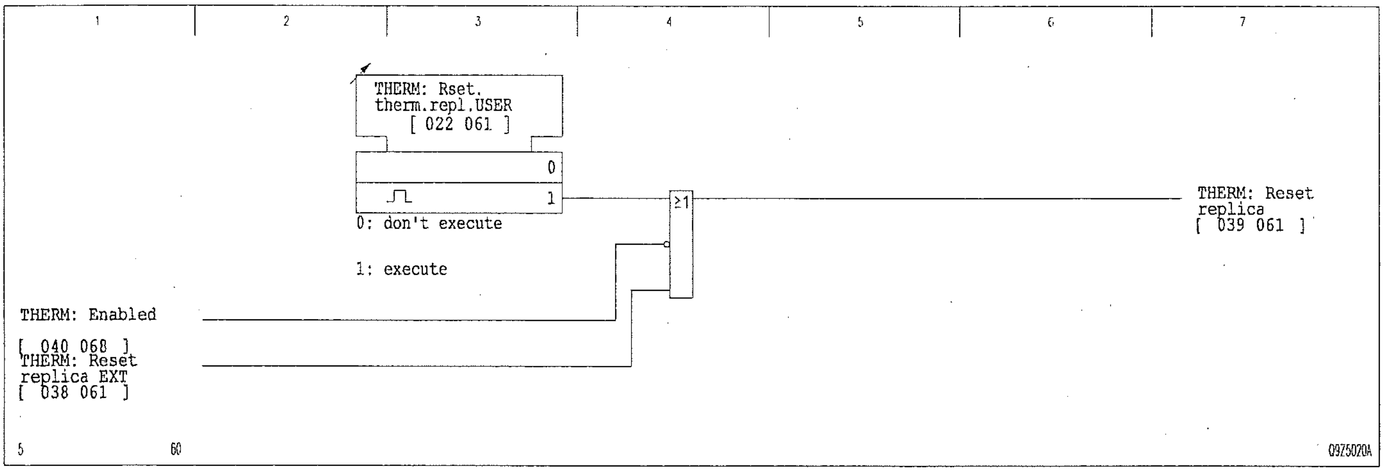
Parameter	THERM: Iref PSx
set 1	072 179
set 2	073 179
set 3	074 179
set 4	075 179

Parameter	THERM: Start. fact.OL_RC PSx
set 1	072 180
set 2	073 180
set 3	074 180
set 4	075 180

Parameter	THERM: Tim. const.1,>Ibl PSx	THERM: Tim. const.2,<Ibl PSx	THERM: Max. perm.obj.tmp.PSx
set 1	072 187	072 188	072 182
set 2	073 187	073 188	073 182
set 3	074 187	074 188	074 182
set 4	075 187	075 188	075 182

Parameter	THERM: Max. perm.cool.tmpPSx	THERM: Default CTA PSx	THERM: Rel. O/T warning PSx	THERM: Rel. O/T trip PSx	THERM: Hysteresis trip PSx	THERM: Warning pre-trip PSx
set 1	072 185	072 186	072 184	072 181	072 183	072 191
set 2	073 185	073 186	073 184	073 181	073 183	073 191
set 3	074 185	074 186	074 184	074 181	074 183	074 191
set 4	075 185	075 186	075 184	075 181	075 183	075 191

3-165 *Thermal overload protection*



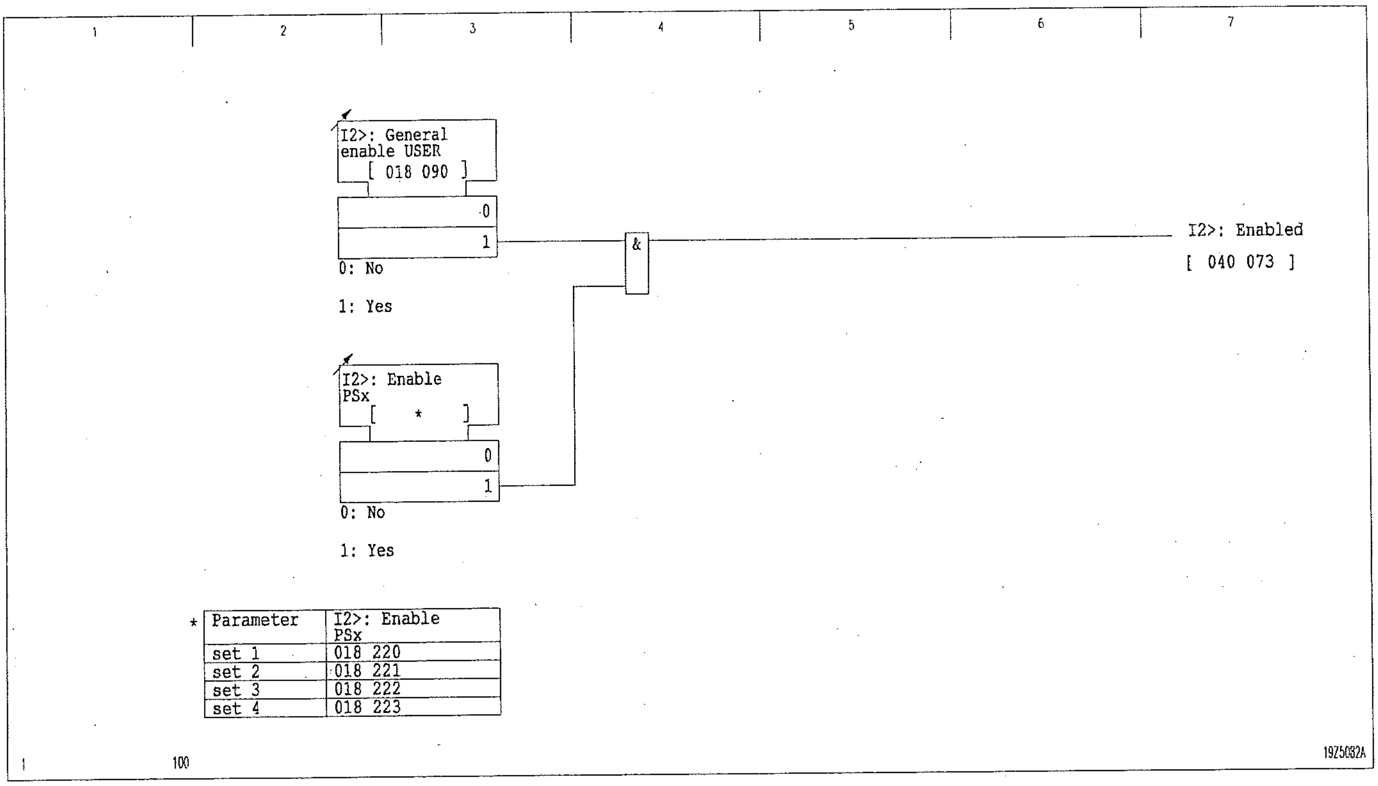
3-166 Reset of the thermal replica

3.30 Unbalance Protection (Function Group I2>)

A two-stage unbalance protection function (I2>) is implemented in the P130C.

Enabling or disabling unbalance protection

Unbalance protection can be disabled or enabled from the local control panel. Moreover, enabling can be carried out separately for each parameter set.



3-167 *Enabling or disabling unbalance protection*

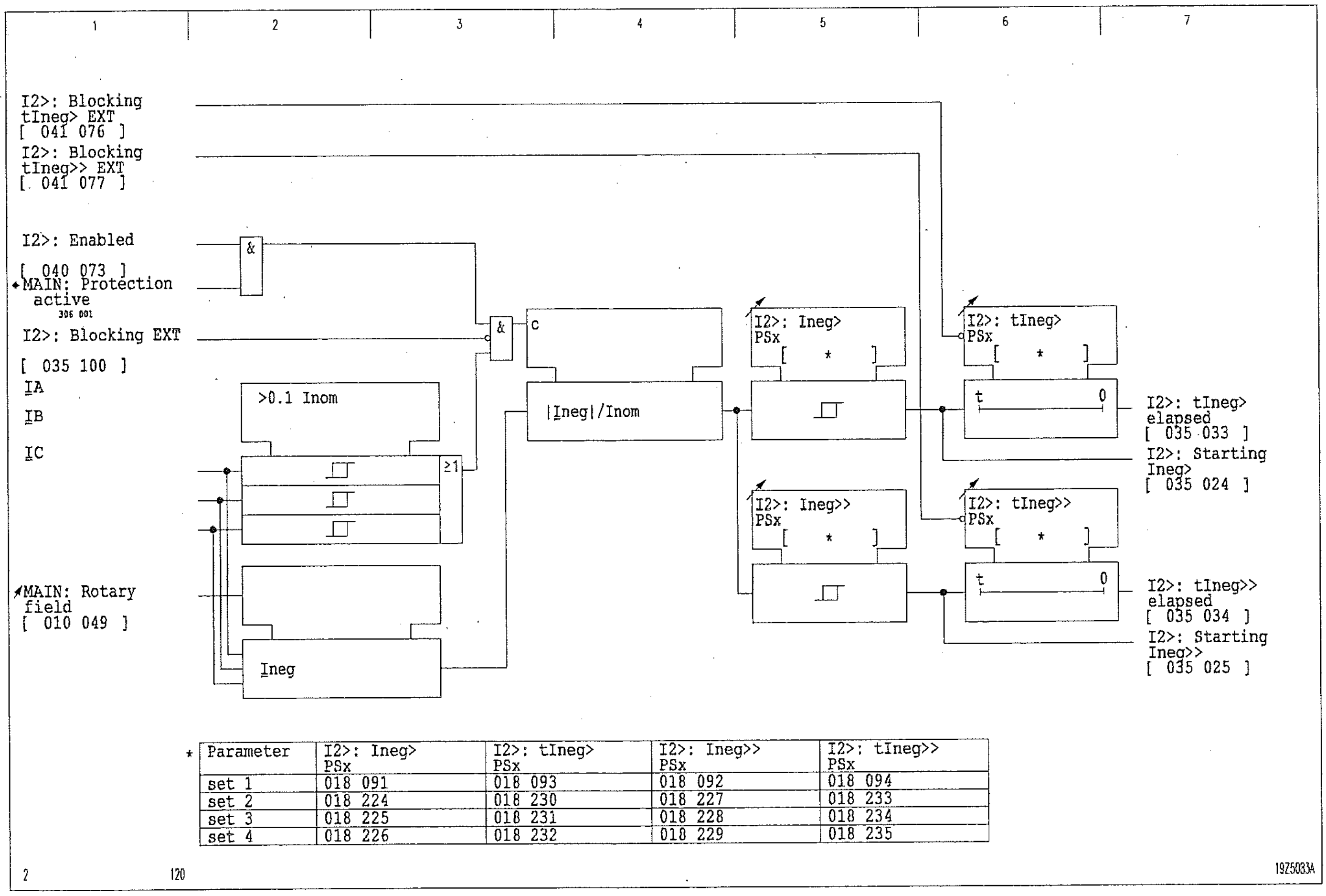
Operation

The presence or absence of unbalance is assessed on the basis of the negative-sequence system current. The negative-sequence current is monitored to determine whether it exceeds the set thresholds. After the set operate delay periods have elapsed, a signal is issued. The following stages are available for the negative-sequence current:

- Unbalance stage I_{neg}> with time delay t_{Ineg}>.
- Unbalance stage I_{neg}>> with time delay t_{Ineg}>>.

The elapsing of all operate delays may be blocked via appropriately configured binary signal inputs.

The unbalance protection signals can be configured to separate output relays. These signals cannot be linked to the general starting signal but can be configured to the trip command.



* Parameter	I2>: Ineg> PSx	I2>: tIneg> PSx	I2>: Ineg>> PSx	I2>: tIneg>> PSx
set 1	018 091	018 093	018 092	018 094
set 2	018 224	018 230	018 227	018 233
set 3	018 225	018 231	018 228	018 234
set 4	018 226	018 232	018 229	018 235

3-168 Unbalance protection

3.31 Time-Voltage Protection (Function Group V<>)

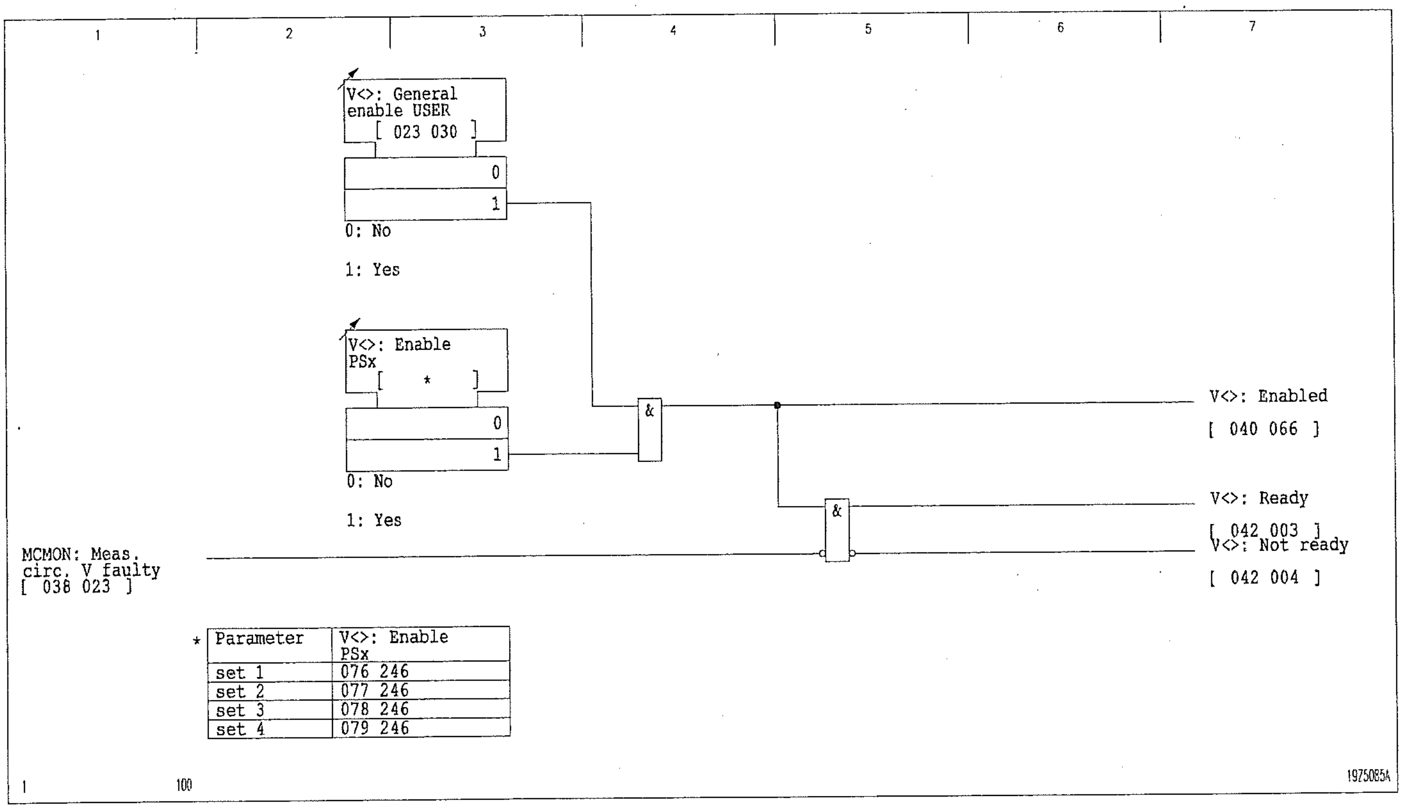
The time-voltage protection function evaluates the fundamental wave of the phase voltages and of the neutral displacement voltage as well as the positive-sequence voltage and negative-sequence voltage obtained from the fundamental waves of the three phase-to-ground voltages.

Disabling or enabling V<> protection

V<> protection can be disabled or enabled from the local control panel. Moreover, enabling can be carried out separately for each parameter set.

V<> protection readiness

V<> protection is ready if it is enabled and no fault has been detected in the voltage-measuring circuit by measuring-circuit monitoring.



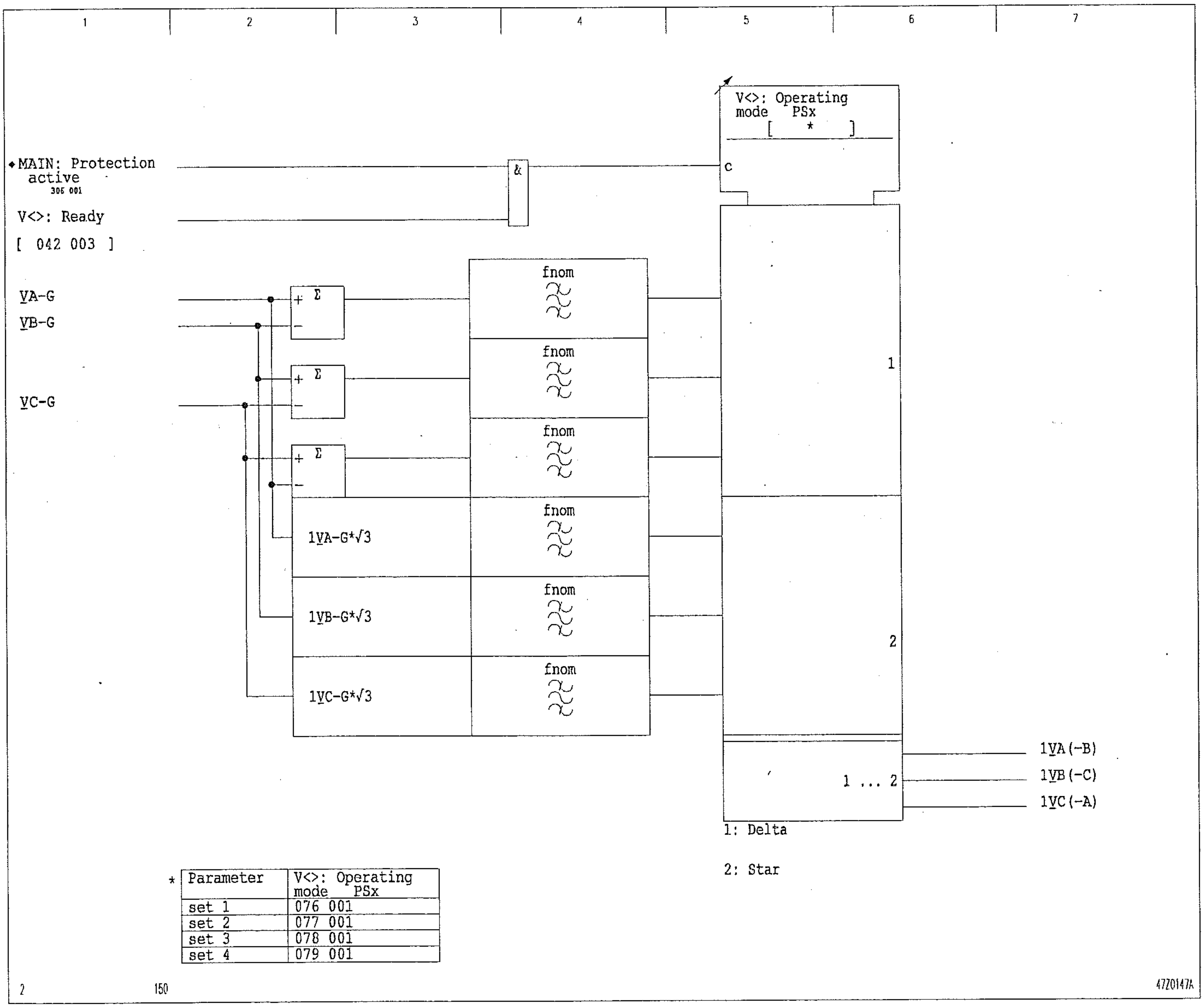
Parameter	V<>: Enable PSx
set 1	076 246
set 2	077 246
set 3	078 246
set 4	079 246

3-169 *Disabling, enabling, and readiness of V<> protection*

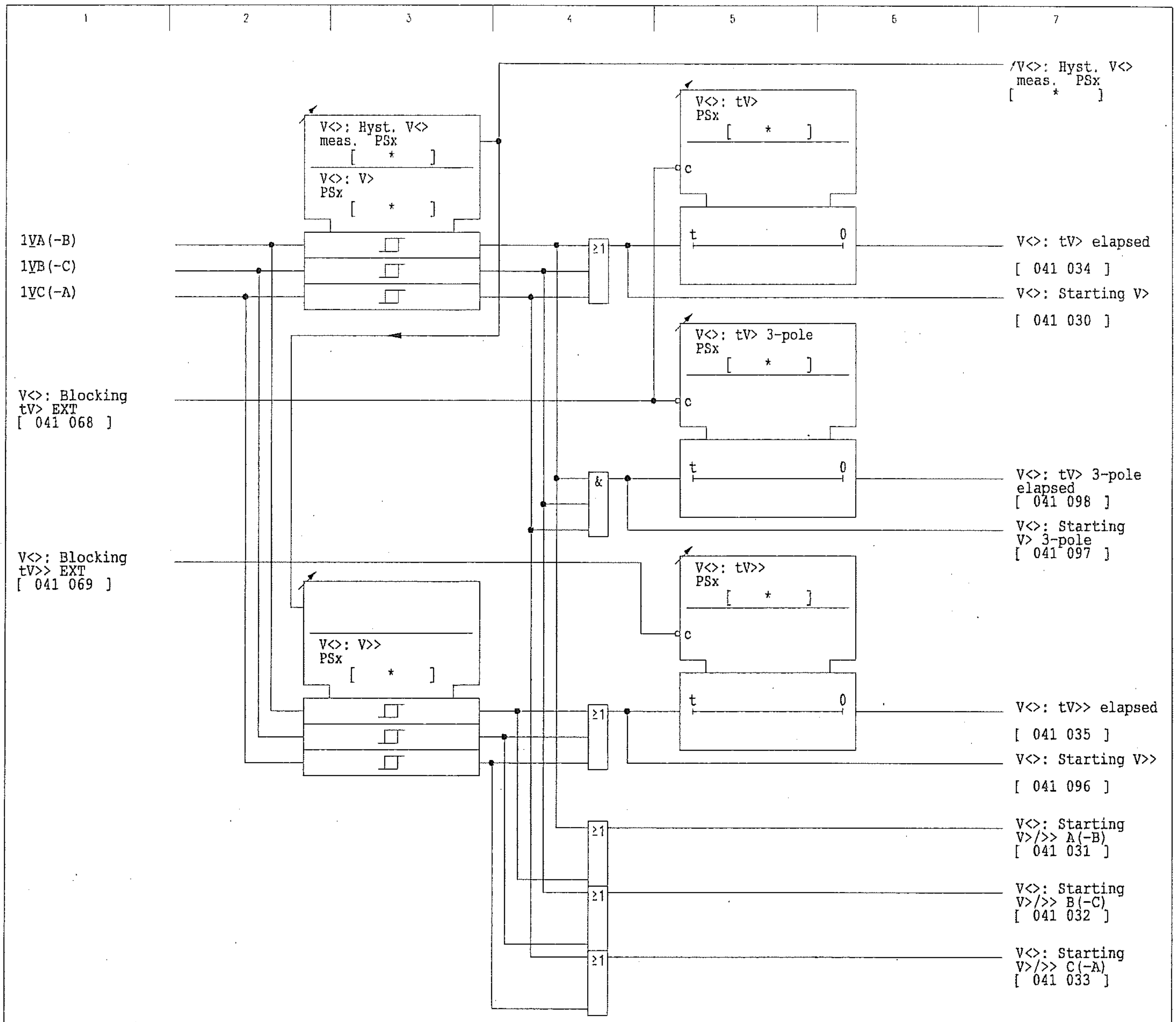
Monitoring the phase voltages

The P130C checks the voltages to determine whether they exceed or fall below set thresholds. Depending on the set operating mode of V<> protection, either the phase-to-ground voltages ('star' operating mode) or the phase-to-phase voltages ('delta' operating mode) are monitored. The triggers are followed by timer stages that can be blocked via appropriately configured binary signal inputs.

If the decisions of undervoltage monitoring are to be included in the trip commands, then it is recommended that transient signals be used. Otherwise the trip command would always be present when the system voltage was disconnected, and thus it would not be possible to reclose the circuit breaker.



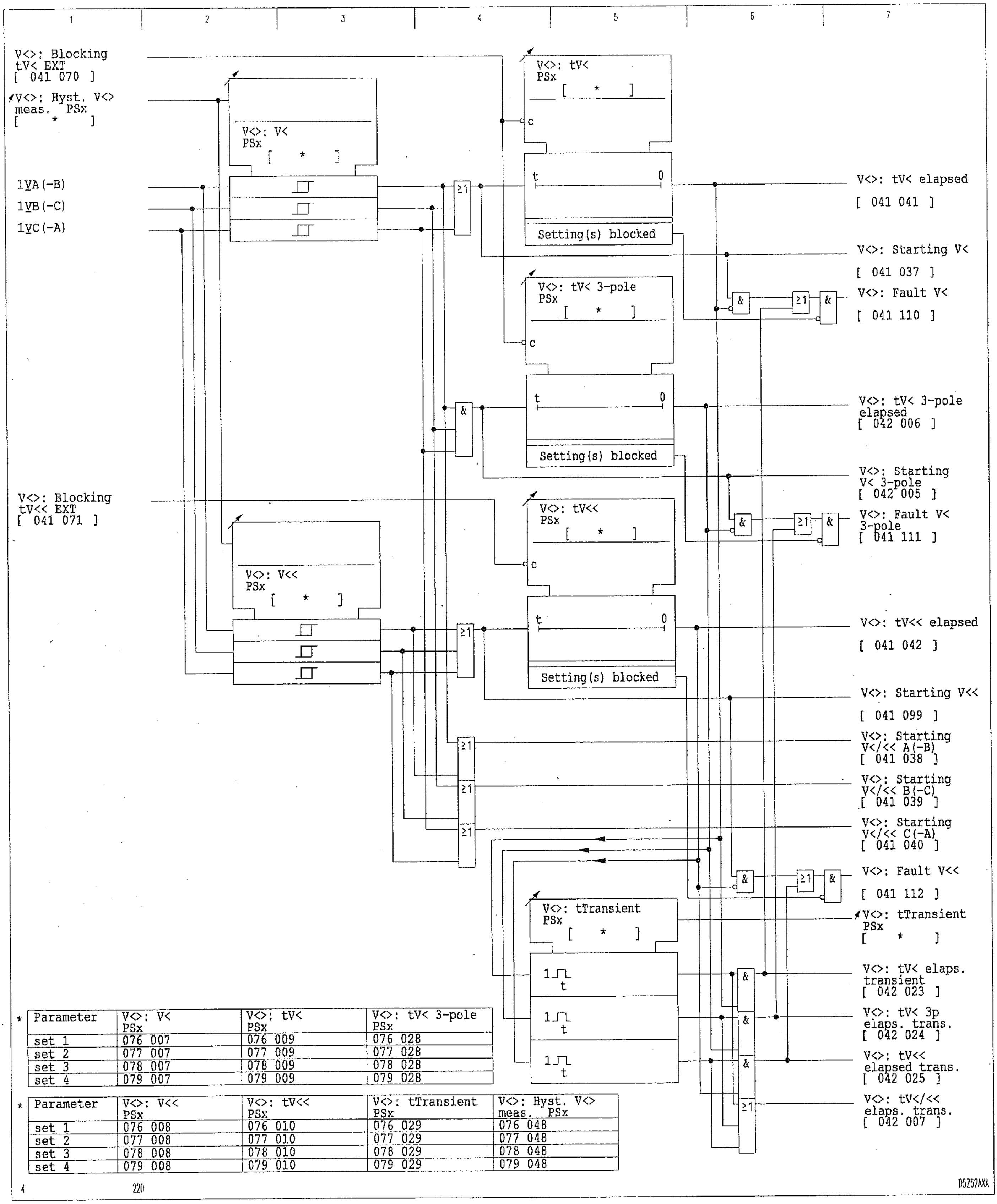
3-170 *Selection of measured variables*



* Parameter	V<>: V> PSx	V<>: tV> PSx	V<>: tV> 3-pole PSx	V<>: V>> PSx	V<>: tV>> PSx	V<>: Hyst. V<> meas. PSx
set 1	076 003	076 005	076 027	076 004	076 006	076 048
set 2	077 003	077 005	077 027	077 004	077 006	077 048
set 3	078 003	078 005	078 027	078 004	078 006	078 048
set 4	079 003	079 005	079 027	079 004	079 006	079 048

3 180 D5Z52AWA

3-171 *Overvoltage monitoring*



* Parameter	V<>: V< PSx	V<>: tV< PSx	V<>: tV< 3-pole PSx
set 1	076 007	076 009	076 028
set 2	077 007	077 009	077 028
set 3	078 007	078 009	078 028
set 4	079 007	079 009	079 028

* Parameter	V<>: V<< PSx	V<>: tV<< PSx	V<>: tTransient PSx	V<>: Hyst. V<> meas. PSx
set 1	076 008	076 010	076 029	076 048
set 2	077 008	077 010	077 029	077 048
set 3	078 008	078 010	078 029	078 048
set 4	079 008	079 010	079 029	079 048

4 220

3-172 Undervoltage monitoring

Monitoring the positive-sequence and negative-sequence voltages

The P130C determines the positive-sequence and negative-sequence voltages from the fundamental components of the phase-to-ground voltages according to the formulas given below, based on the MAIN: Rotary field setting.

Clockwise rotary field:

Positive-sequence voltage: $$\underline{V}_{pos} = \frac{1}{3} \cdot \left| \left(\underline{V}_{A-G} + \underline{a} \cdot \underline{V}_{B-G} + \underline{a}^2 \cdot \underline{V}_{C-G} \right) \right|$$

Negative-sequence voltage: $$\underline{V}_{neg} = \frac{1}{3} \cdot \left| \left(\underline{V}_{A-G} + \underline{a}^2 \cdot \underline{V}_{B-G} + \underline{a} \cdot \underline{V}_{C-G} \right) \right|$$

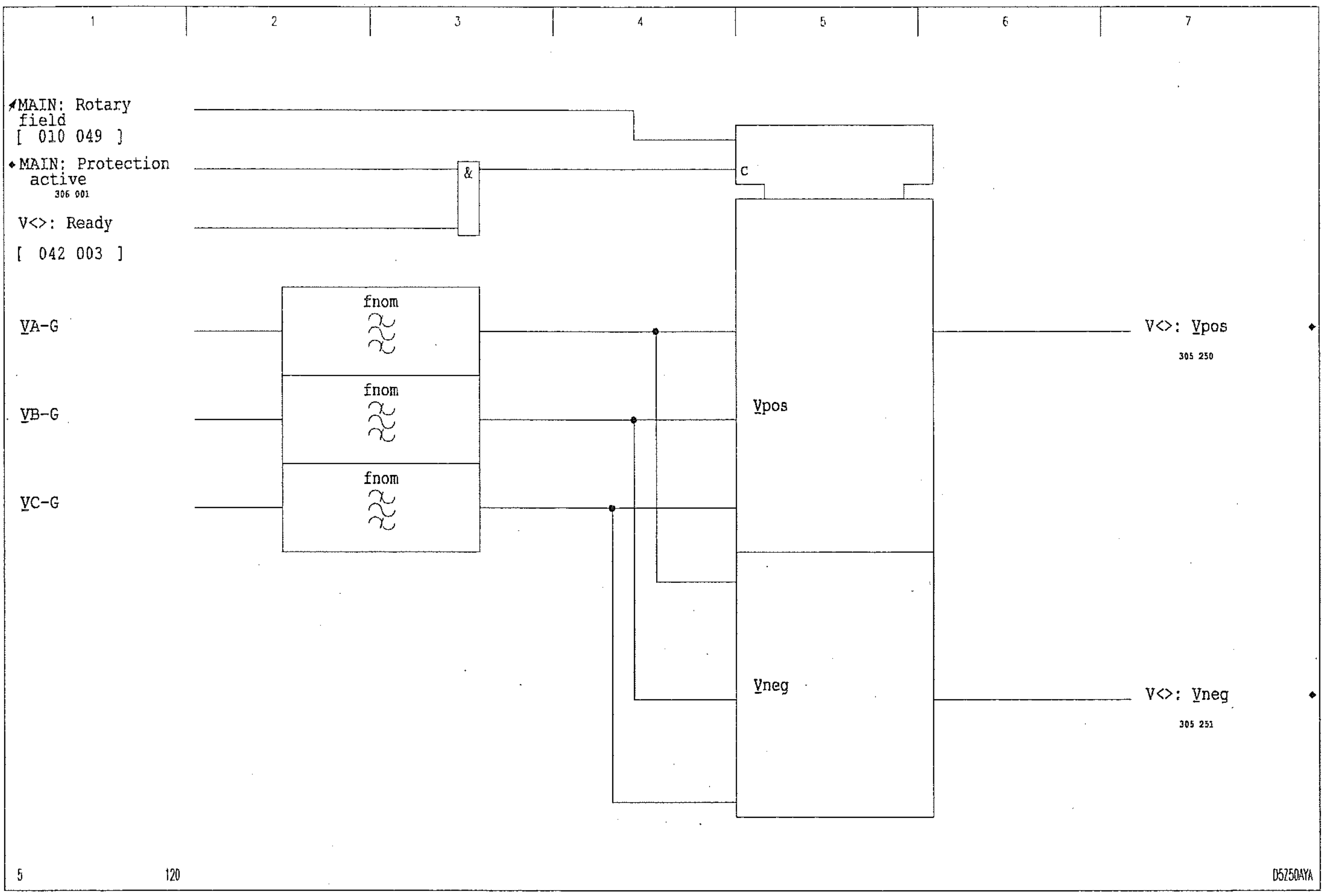
Anti-clockwise rotary field:

Positive-sequence voltage: $$\underline{V}_{pos} = \frac{1}{3} \cdot \left| \left(\underline{V}_{A-G} + \underline{a}^2 \cdot \underline{V}_{B-G} + \underline{a} \cdot \underline{V}_{C-G} \right) \right|$$

Negative-sequence voltage: $$\underline{V}_{neg} = \frac{1}{3} \cdot \left| \left(\underline{V}_{A-G} + \underline{a} \cdot \underline{V}_{B-G} + \underline{a}^2 \cdot \underline{V}_{C-G} \right) \right|$$

$\underline{a} = e^{j120°}$

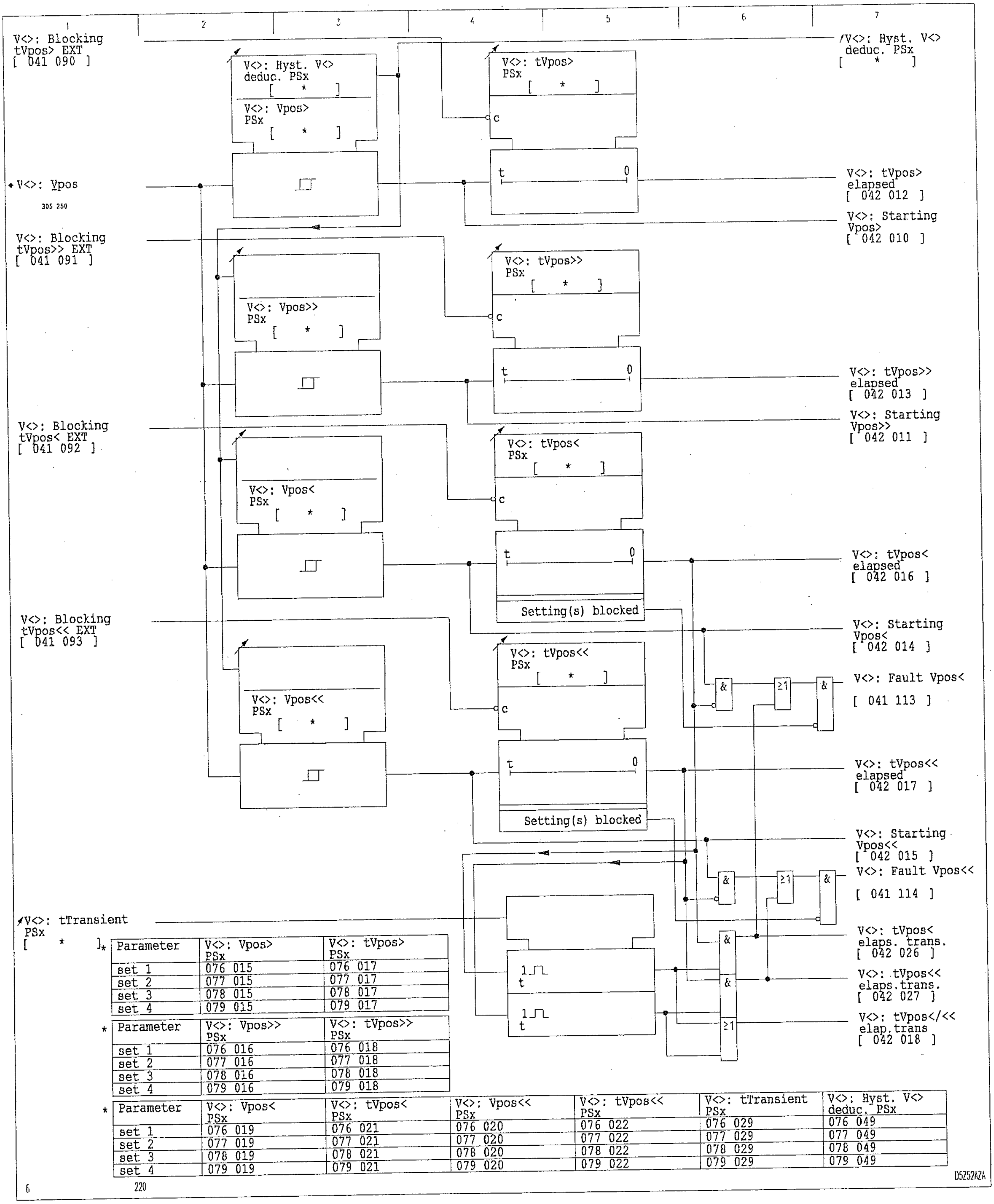
$\underline{a}^2 = e^{j240°}$



3-173 Determining positive-sequence and negative-sequence voltages

The positive-sequence voltage is monitored to determine whether it exceeds or falls below set thresholds, and the negative-sequence voltage is monitored to determine whether it exceeds set thresholds. If the voltage exceeds or falls below the set thresholds, then a signal is issued once the set operate delays have elapsed. The timer stages may be blocked via appropriately configured binary signal inputs.

If the decisions of undervoltage monitoring are to be included in the trip commands, then it is recommended that transient signals be used. Otherwise the trip command would always be present when the system voltage was disconnected, and thus it would not be possible to reclose the circuit breaker.

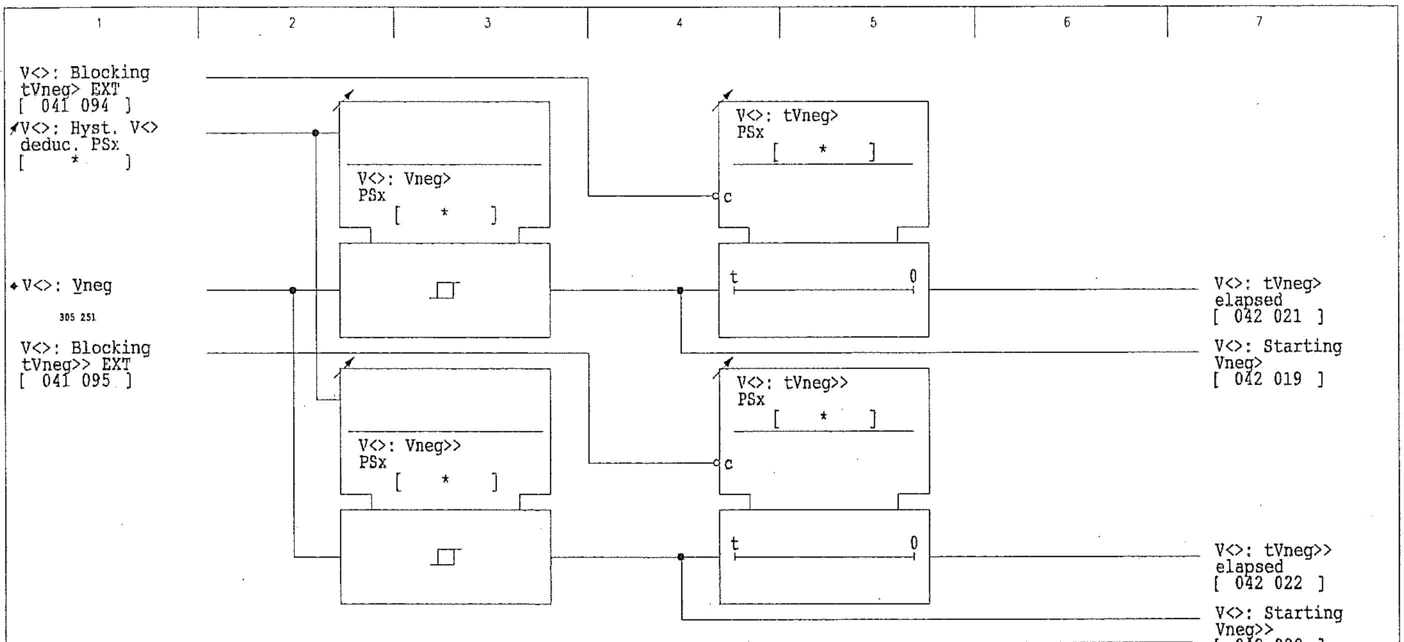


Parameter	V<>: Vpos> PSx	V<>: tVpos> PSx
set 1	076 015	076 017
set 2	077 015	077 017
set 3	078 015	078 017
set 4	079 015	079 017

Parameter	V<>: Vpos>> PSx	V<>: tVpos>> PSx
set 1	076 016	076 018
set 2	077 016	077 018
set 3	078 016	078 018
set 4	079 016	079 018

Parameter	V<>: Vpos< PSx	V<>: tVpos< PSx	V<>: Vpos<< PSx	V<>: tVpos<< PSx	V<>: tTransient PSx	V<>: Hyst. V<> deduc. PSx
set 1	076 019	076 021	076 020	076 022	076 029	076 049
set 2	077 019	077 021	077 020	077 022	077 029	077 049
set 3	078 019	078 021	078 020	078 022	078 029	078 049
set 4	079 019	079 021	079 020	079 022	079 029	079 049

3-174 *Monitoring the positive-sequence voltage*



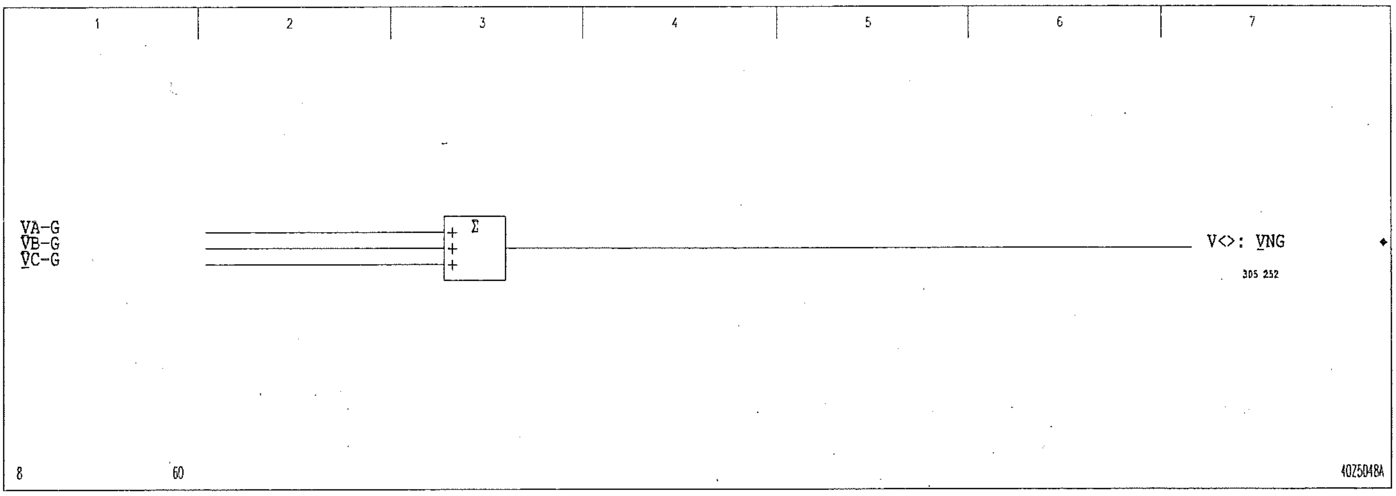
* Parameter	V<>: Vneg> PSx	V<>: tVneg> PSx	V<>: Vneg>> PSx	V<>: tVneg>> PSx	V<>: Hyst. V<> deduc. PSx
set 1	076 023	076 025	076 024	076 026	076 049
set 2	077 023	077 025	077 024	077 026	077 049
set 3	078 023	078 025	078 024	078 026	078 049
set 4	079 023	079 025	079 024	079 026	079 049

7 100 D5Z52BAA

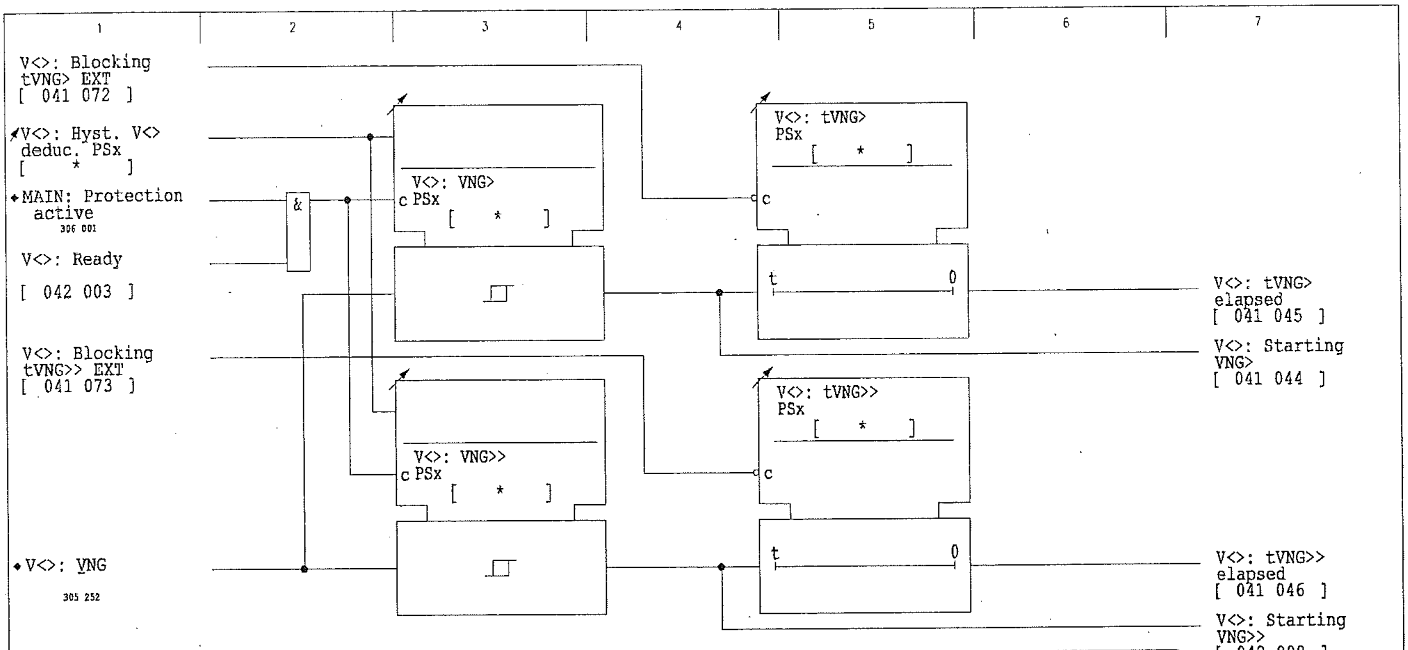
3-175 Monitoring the negative-sequence voltage

Monitoring the neutral-displacement voltage

The V<> function monitors either the neutral-displacement voltage calculated by the P130C from the three phase-to-ground voltages. The neutral displacement voltage is monitored to determine whether it exceeds set thresholds. The triggers are followed by timer stages that can be blocked via appropriately configured binary signal inputs.



3-176 Conditioning the measured variable



* Parameter	V<>: VNG> PSx	V<>: tVNG> PSx	V<>: VNG>> PSx	V<>: tVNG>> PSx	V<>: Hyst. V<> deduc. PSx
set 1	076 011	076 013	076 012	076 014	076 049
set 2	077 011	077 013	077 012	077 014	077 049
set 3	078 011	078 013	078 012	078 014	078 049
set 4	079 011	079 013	079 012	079 014	079 049

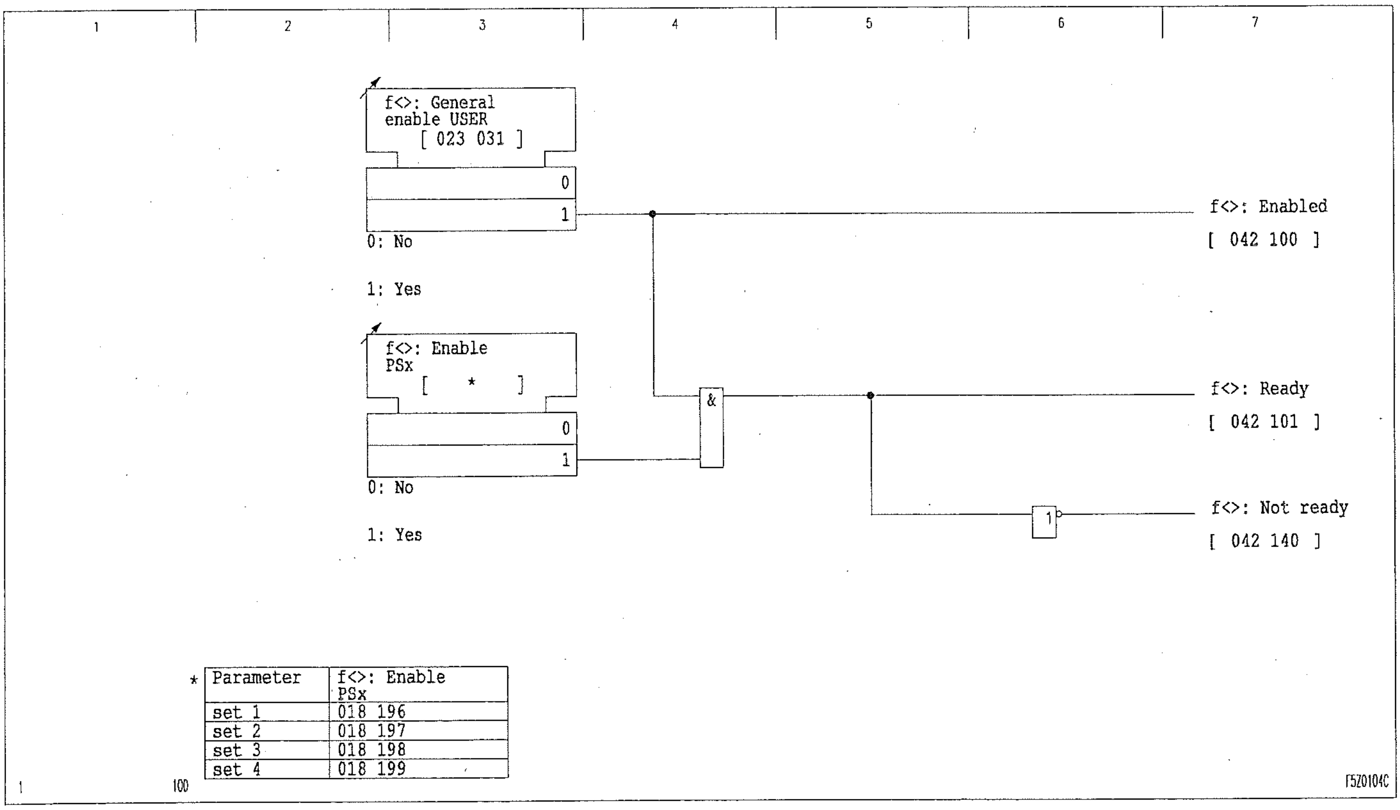
3-177 *Monitoring the neutral-displacement voltage*

3.32 Over-/Underfrequency Protection (Function Group f<>)

The P130C monitors the selected voltage to determine whether it exceeds or falls below set frequencies. The frequency is determined from the difference in time between the zero crossings of the voltage (voltage zeroes). The over-/underfrequency protection function has four stages. The operation of over-/underfrequency protection will be explained below using the first stage as an example.

Disabling or enabling over-/underfrequency protection

Over-/underfrequency protection can be disabled or enabled from the local control panel. Moreover, enabling can be done separately for each parameter subset.

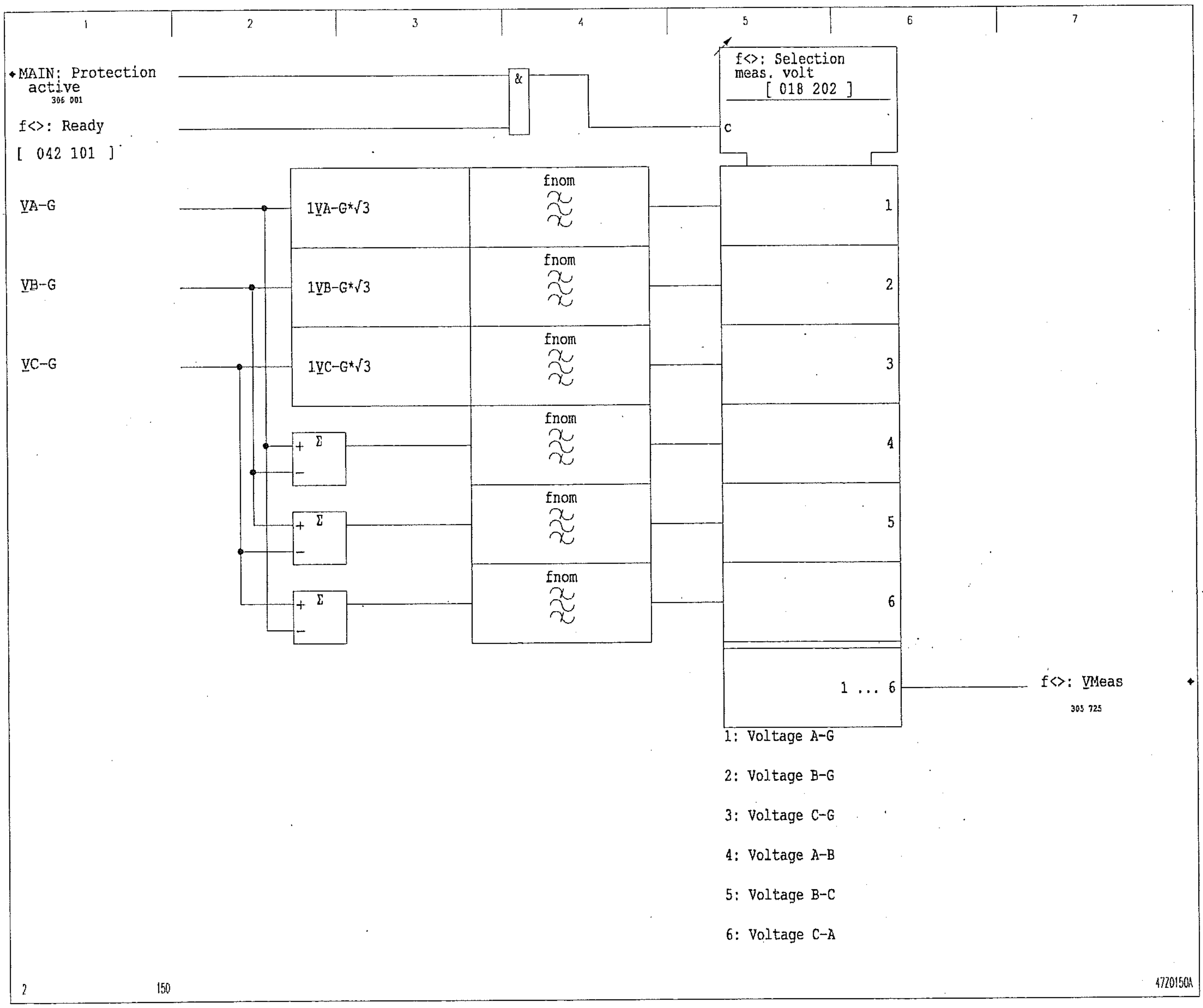


* Parameter	f<>: Enable PSx
set 1	018 196
set 2	018 197
set 3	018 198
set 4	018 199

3-178 Disabling, enabling, and readiness of f<> protection

Selecting the measuring voltage

By selecting a measuring voltage setting, the user defines the voltage that is used by the over-/underfrequency protection function for measurement purposes. This can be either a phase-to-ground voltage or a phase-to-phase voltage.

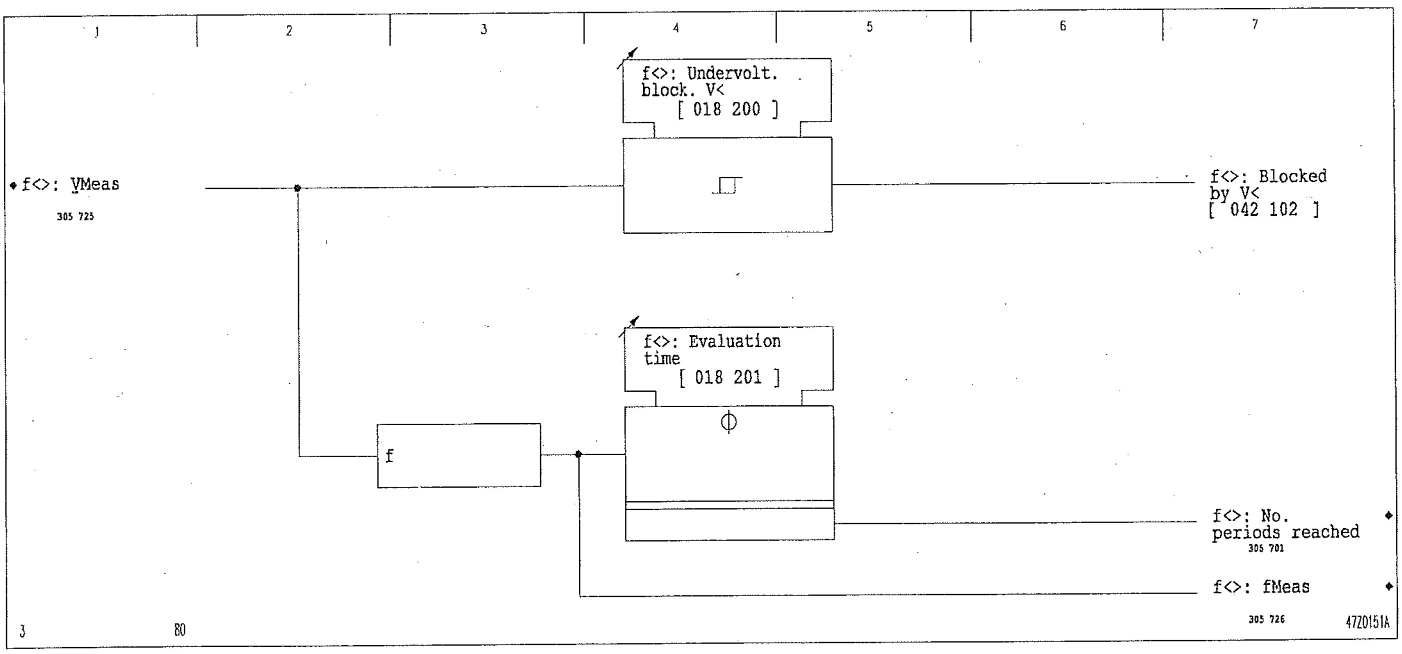


3-179 Selecting the measuring voltage

Undervoltage blocking and evaluation time

Over-/underfrequency protection requires a measuring voltage of sufficient magnitude. Over-/underfrequency protection will be blocked instantaneously if the measuring voltage falls below the set threshold of the undervoltage stage.

In order to avoid frequency stage starting caused by brief frequency fluctuations or interference, the evaluation time can be set by the user. The operate conditions must be satisfied for at least the duration of the set evaluation time in order for a signal to be issued.



3-180 Undervoltage blocking and evaluation time setting

Operating modes of over-/ underfrequency protection

For each stage of the over-/underfrequency protection function, the user can choose between the following operating modes:

- Frequency monitoring
- Frequency monitoring combined with differential frequency gradient monitoring (df/dt)
- Frequency monitoring combined with mean frequency gradient monitoring ($\Delta f/\Delta t$)

Frequency monitoring

Depending on the setting, the P130C monitors the frequency to determine whether it exceeds or falls below set thresholds. If an operate threshold in excess of the set nominal frequency is set, the P130C checks to determine whether the frequency exceeds the operate threshold. If an operate threshold below the set nominal frequency is set, the P130C checks to determine whether the frequency falls below the operate threshold. If it exceeds or falls below the set threshold, a set timer stage is started. The timer stage can be blocked by way of an appropriately configured binary signal input.

Frequency monitoring combined with differential frequency gradient monitoring (df/dt)

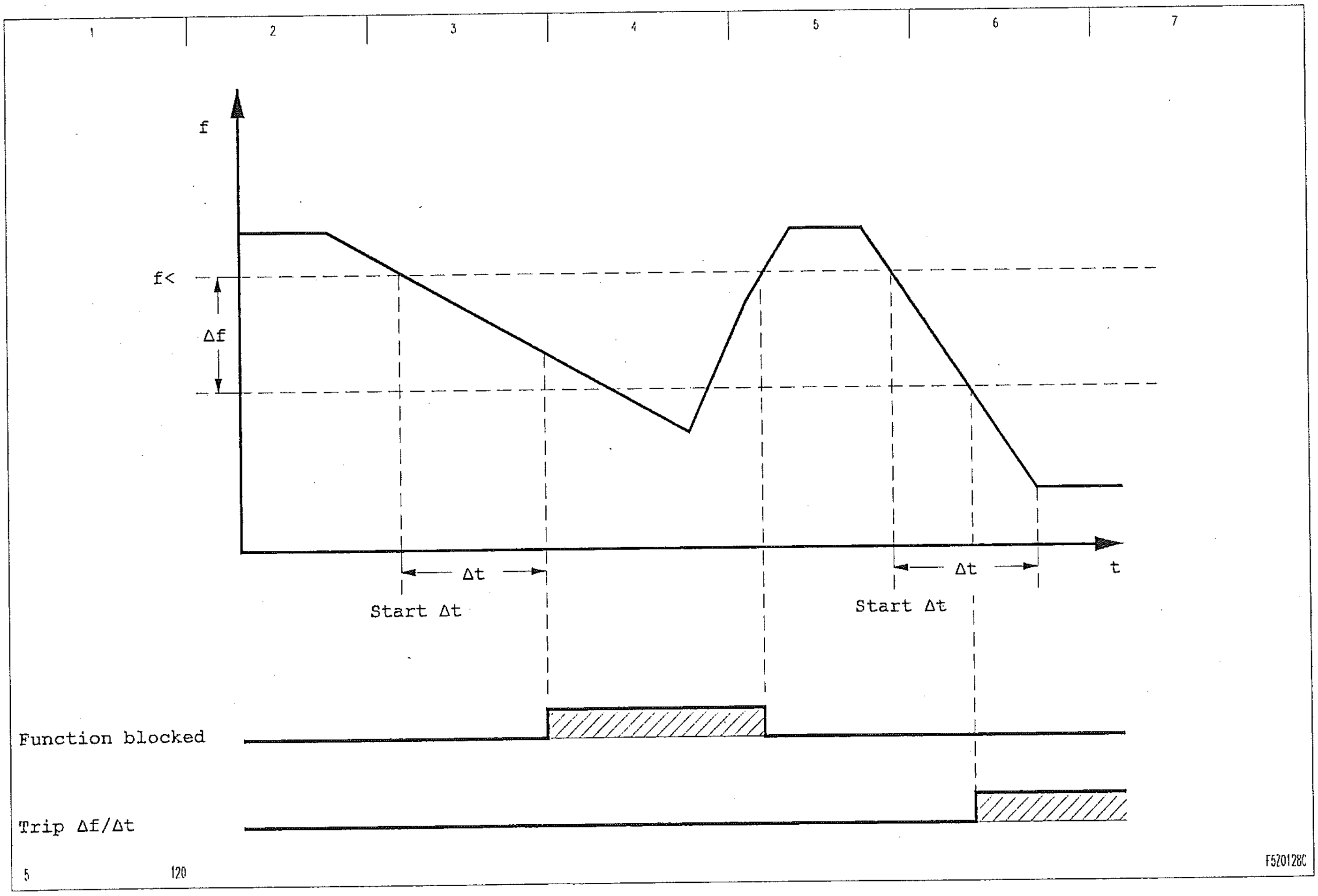
In this operating mode of the over-/ underfrequency protection function, the frequency is also checked to determine whether the set frequency gradient is reached (in addition to being monitored for exceeding or falling below the set threshold). Monitoring for overfrequency is combined with monitoring for a frequency increase; monitoring for underfrequency is combined with monitoring for a frequency decrease. If both operate conditions are satisfied, a set timer stage is started. The timer stage can be blocked by way of an appropriately configured binary signal input.

Frequency monitoring combined with mean frequency gradient monitoring (Δf/Δt)

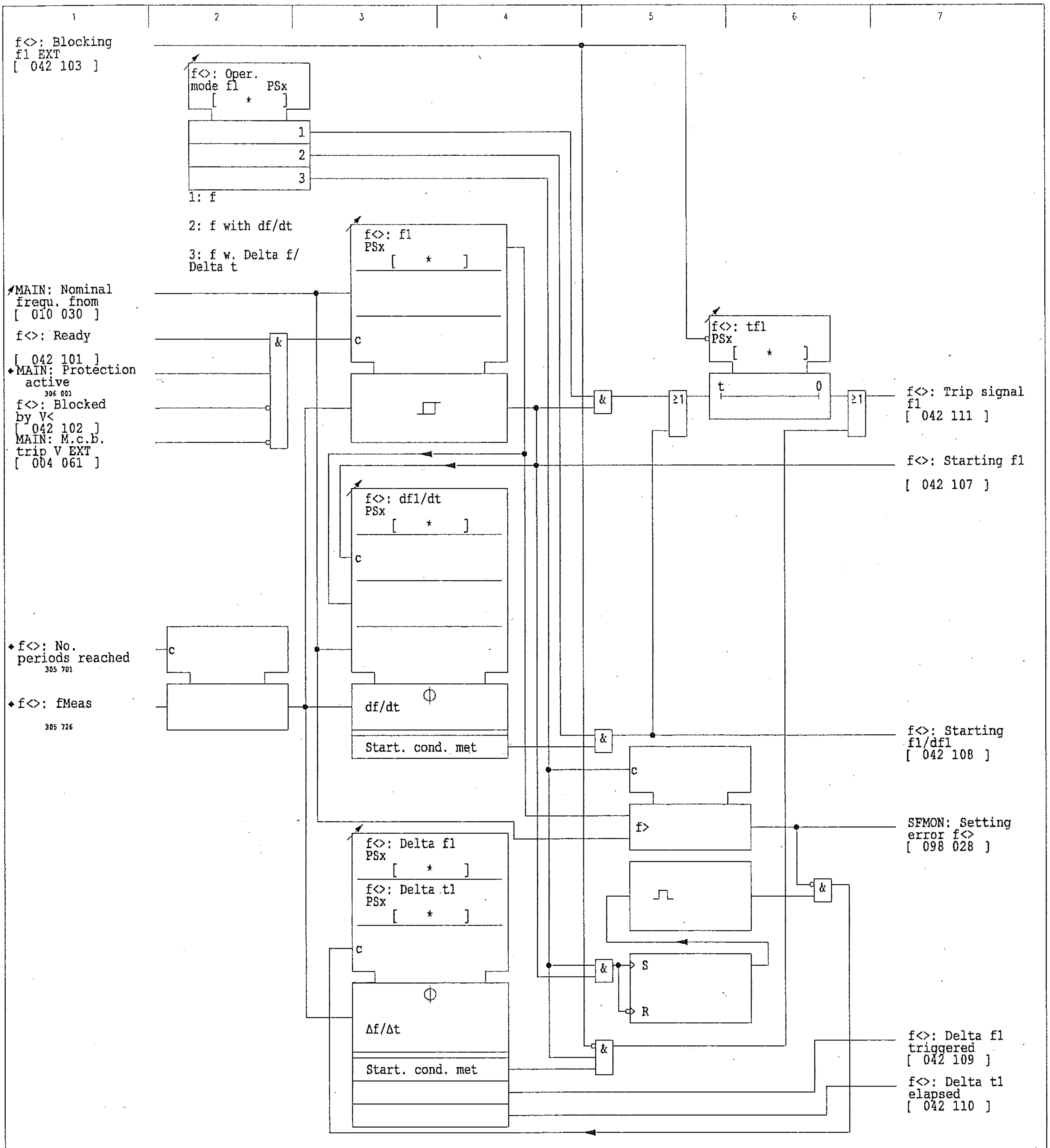
The frequency gradient can differ for system disturbances in individual substations and may vary over time due to power swings. Therefore it makes sense to take the mean value of the frequency gradient into account for load-shedding systems.

In this operating mode of over-/underfrequency protection, frequency monitoring must be set for 'underfrequency monitoring'.

Monitoring the mean value of the frequency gradient is started with the starting of frequency monitoring. If the frequency decreases by the set value Δf within the set time Δt, then the Δt/Δf monitoring function operates instantaneously and generates a trip signal. If a frequency change does not lead to an operate decision of the monitoring function, then the Δt/Δf monitoring function will be blocked until the underfrequency monitoring function drops out. The trip signal can be blocked by way of an appropriately configured binary signal input.



3-181 *Operation of frequency monitoring combined with Δf/Δt monitoring*



* Parameter	f<>: Oper. mode f1 PSx	f<>: f1 PSx	f<>: df1/dt PSx	f<>: Delta f1 PSx	f<>: Delta t1 PSx	f<>: tf1 PSx
set 1	018 120	018 100	018 108	018 112	018 116	018 104
set 2	018 121	018 101	018 109	018 113	018 117	018 105
set 3	018 122	018 102	018 110	018 114	018 118	018 106
set 4	018 123	018 103	018 111	018 115	018 119	018 107

4 220 47Z0152A

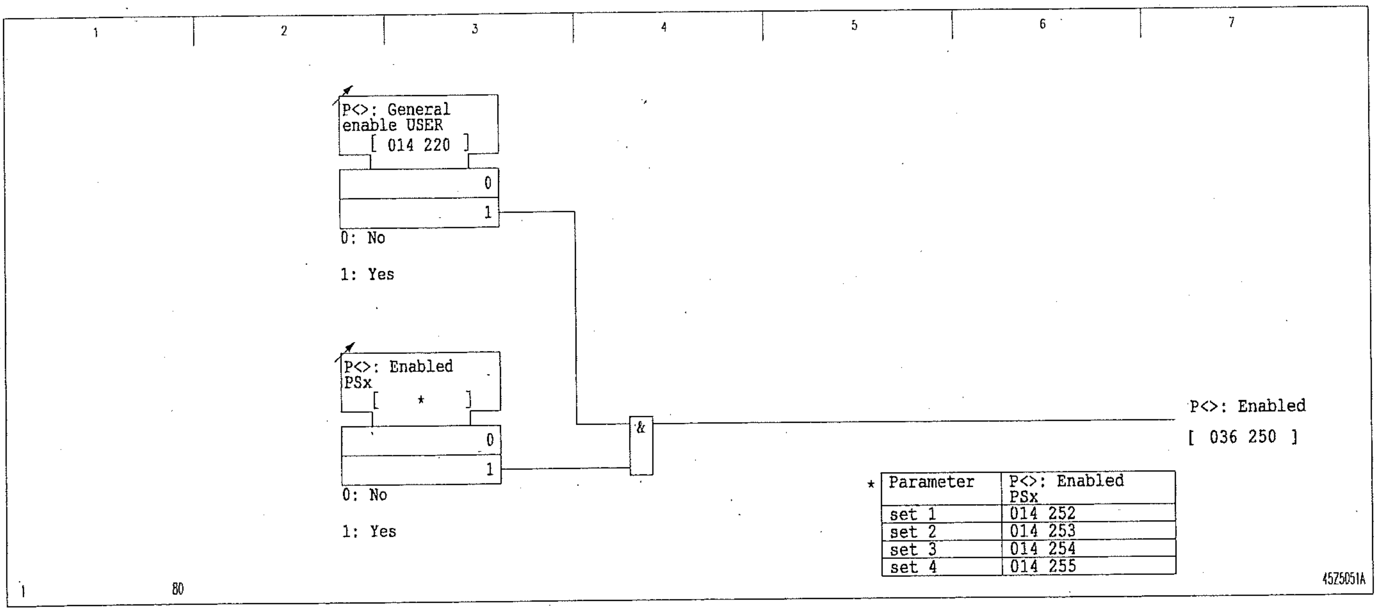
3-182 First stage of the over-/ underfrequency protection function

3.33 Power Directional Protection (Function Group P<>)

The power directional protection function determines the active and reactive power from the fundamental waves of current and voltage. The sign of the active or the reactive power, respectively, is evaluated for direction determination.

Disabling or enabling P<> protection

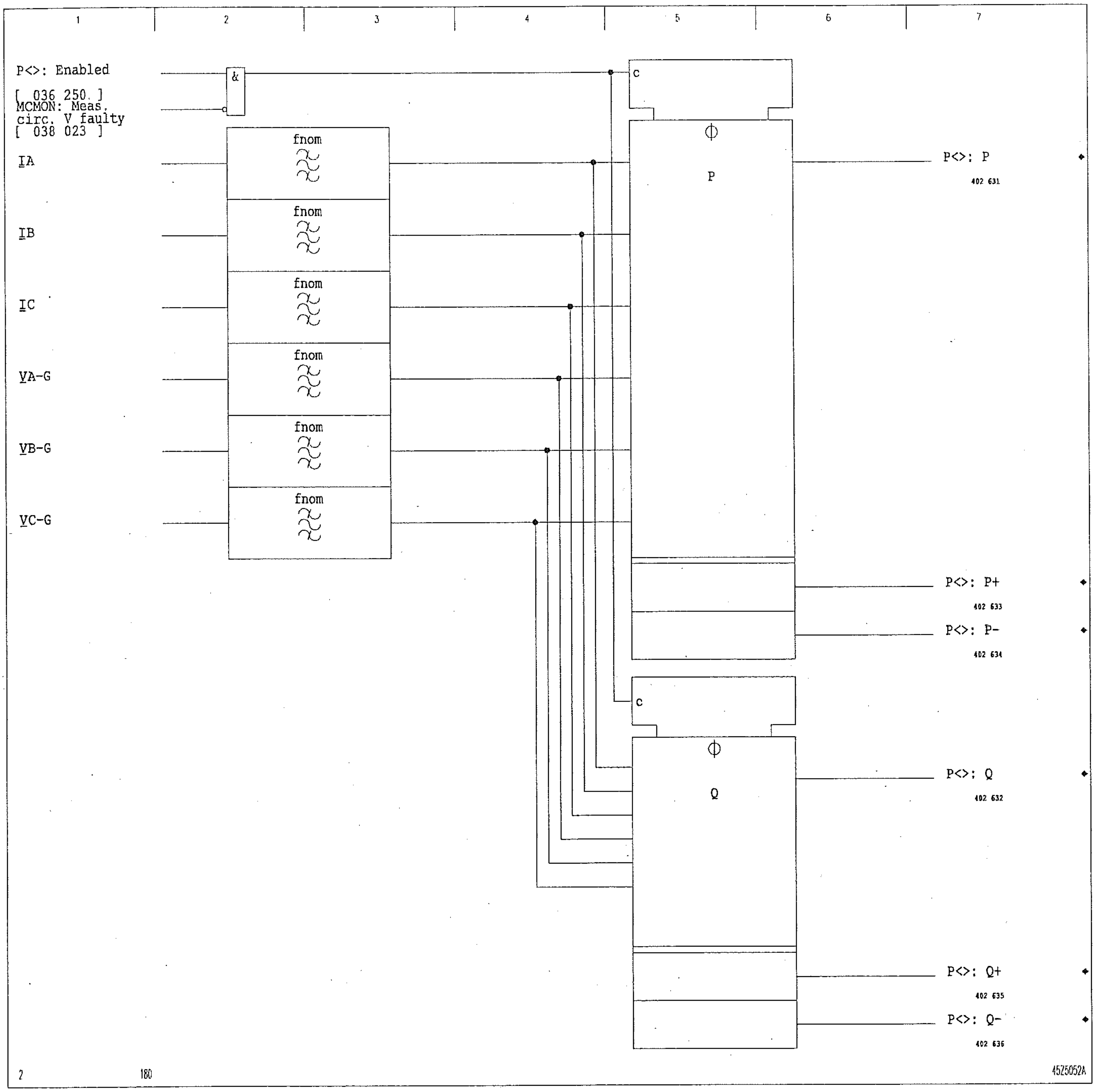
The power directional protection function can be disabled or enabled from the local control panel. Moreover, enabling can be carried out separately for each parameter set.



3-183 *Enabling or disabling power directional protection*

Power determination

The P130C determines the active and reactive power from the fundamental waves of the three phase currents and the phase-to-ground voltages. If the measuring-circuit monitoring function detects malfunctioning in the voltage measuring circuit, power determination will be blocked.

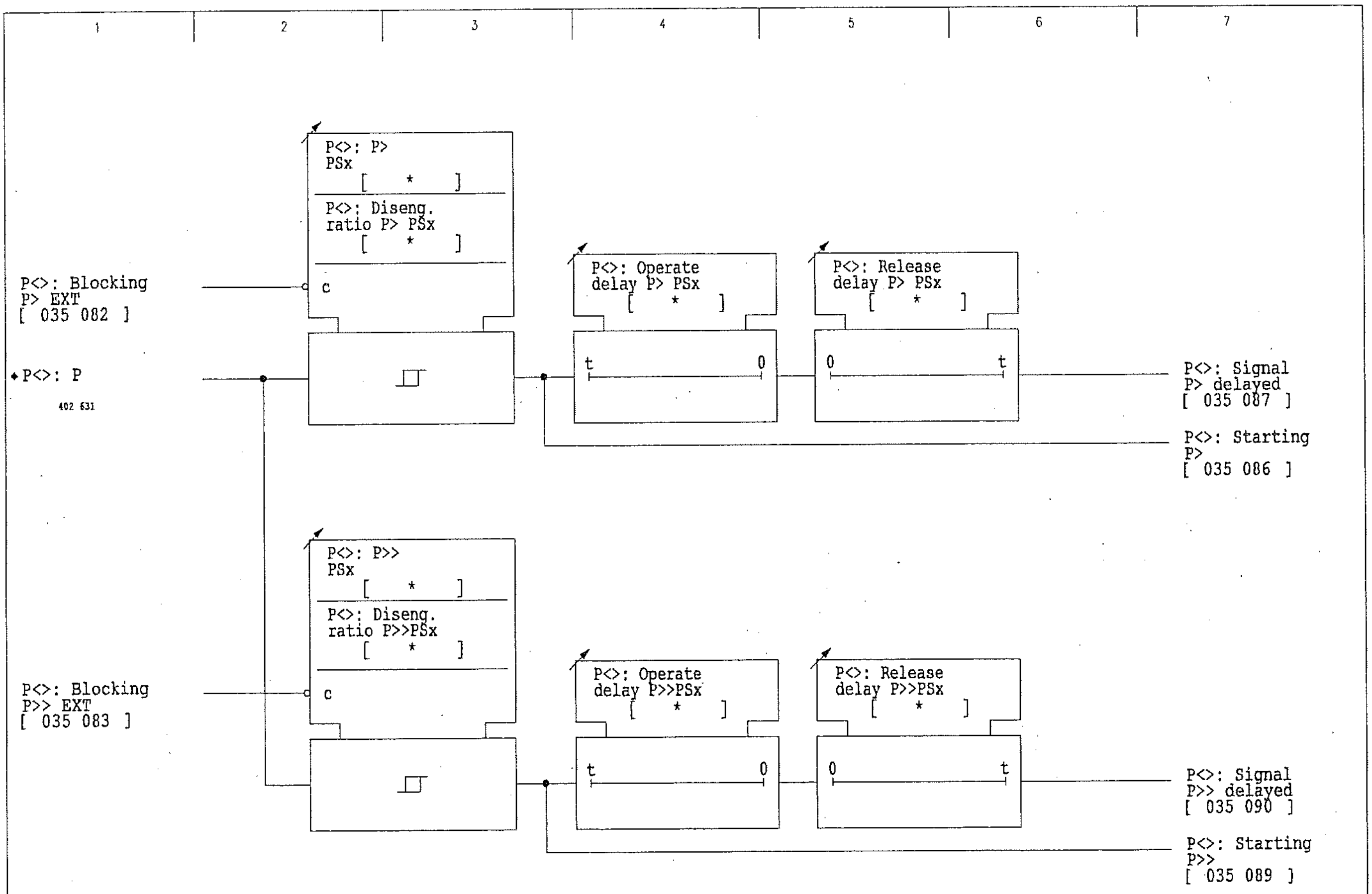


3-184 Power determination

Active power monitoring

The P130C monitors the active power with two-stage functions to detect when it exceeds the set thresholds. The disengaging ratio of the threshold stages can be set.

When the active power exceeds the set thresholds, a starting results. The starting signal is followed by the set operate and release delays.



* Parameter	P<>: P> PSx	P<>: Diseng. ratio P> PSx	P<>: Operate delay P> PSx	P<>: Release delay P> PSx
set 1	017 120	017 124	017 128	017 132
set 2	017 200	017 125	017 129	017 133
set 3	017 201	017 126	017 130	017 134
set 4	017 202	017 127	017 131	017 135

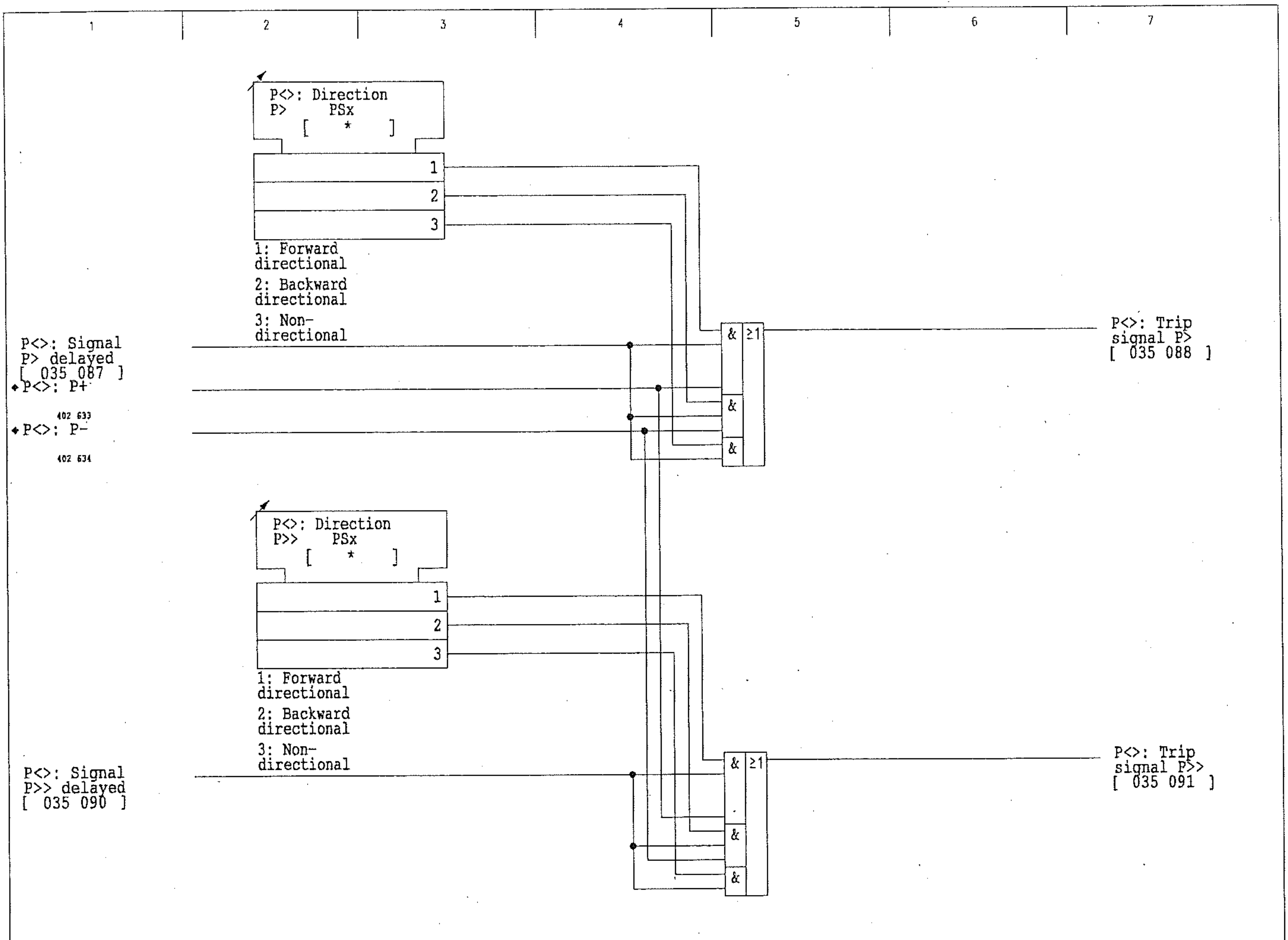
* Parameter	P<>: P>> PSx	P<>: Diseng. ratio P>>PSx	P<>: Operate delay P>>PSx	P<>: Release delay P>>PSx
set 1	017 140	017 144	017 148	017 152
set 2	017 141	017 145	017 149	017 153
set 3	017 142	017 146	017 150	017 154
set 4	017 143	017 147	017 151	017 155

3 150 19Z5049A

3-185 Active power monitoring

Active power direction

The P130C determines the sign of the active power. If the sign is positive, a forward-directional decision is issued; if it is negative, a backward-directional decision results. A setting determines whether a trip signal is triggered by a forward-directional, a backward-directional or a non-directional decision.



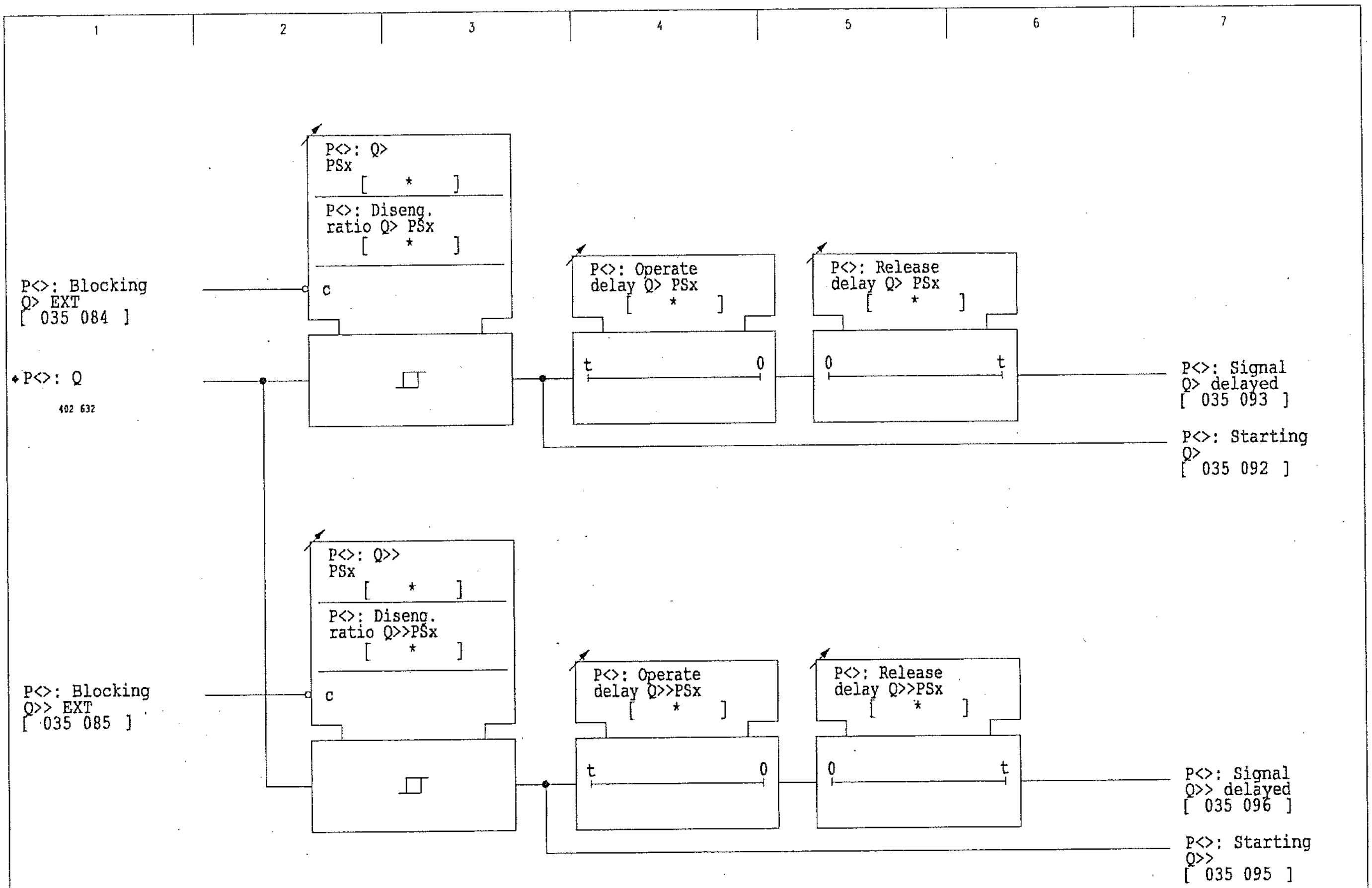
* Parameter	P<>: Direction P> PSx	P<>: Direction P>> PSx
set 1	017 136	017 156
set 2	017 137	017 157
set 3	017 138	017 158
set 4	017 139	017 159

3-186 *The direction-dependent trip signal of the active power protection function*

Reactive power monitoring

The P130C monitors the reactive power with two-stage functions to detect when it exceeds the set thresholds. The disengaging ratio of the threshold stages can be set.

When the reactive power exceeds the set thresholds, a starting results. The starting signal is followed by the set operate and release delays.



* Parameter	P<>: Q> PSx	P<>: Diseng. ratio Q> PSx	P<>: Operate delay Q> PSx	P<>: Release delay Q> PSx
set 1	017 160	017 164	017 168	017 172
set 2	017 161	017 165	017 169	017 173
set 3	017 162	017 166	017 170	017 174
set 4	017 163	017 167	017 171	017 175

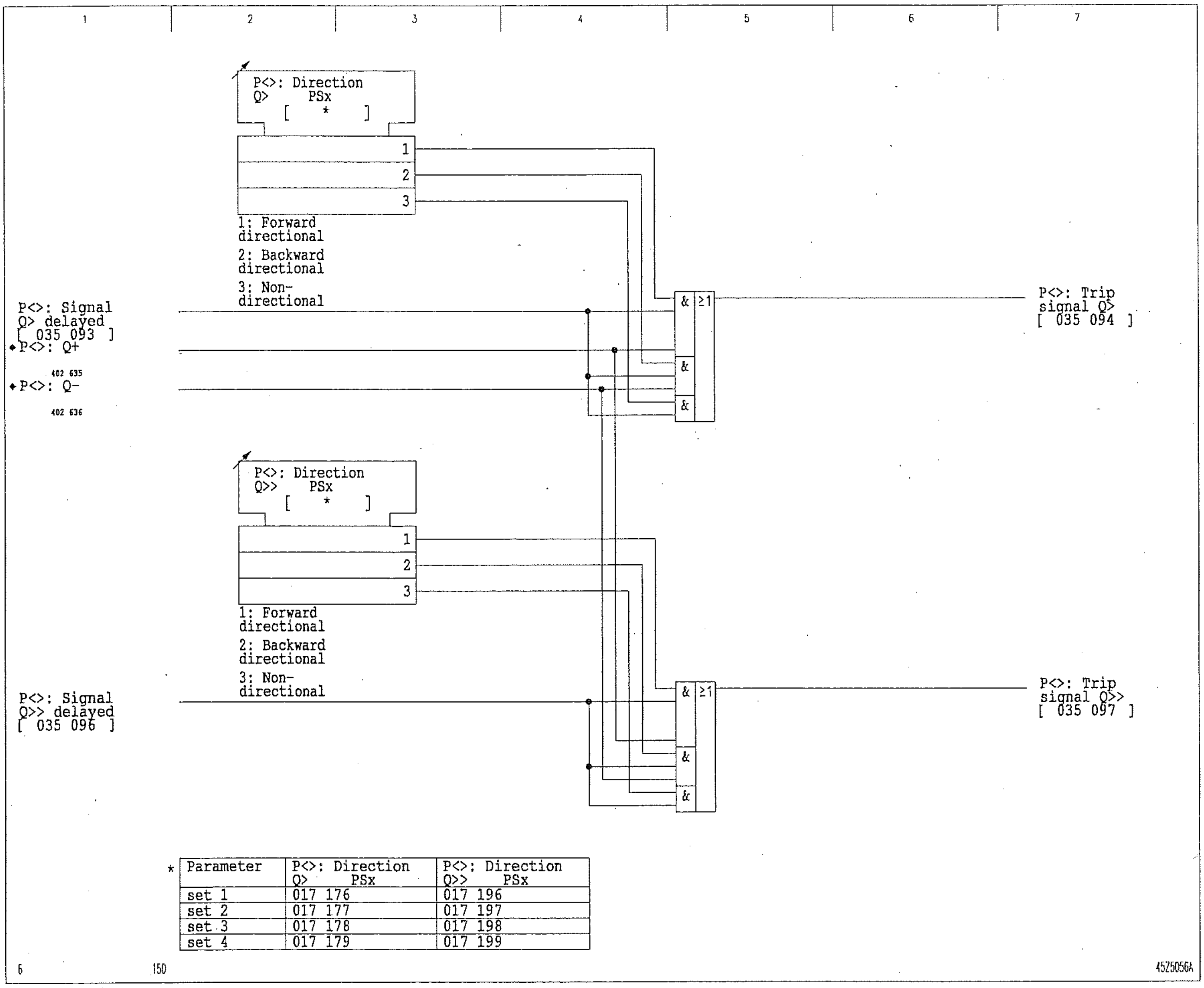
* Parameter	P<>: Q>> PSx	P<>: Diseng. ratio Q>>PSx	P<>: Operate delay Q>>PSx	P<>: Release delay Q>>PSx
set 1	017 180	017 184	017 188	017 192
set 2	017 181	017 185	017 189	017 193
set 3	017 182	017 186	017 190	017 194
set 4	017 183	017 187	017 191	017 195

5 150 19Z50ASA

3-187 *Reactive power monitoring*

Reactive power direction

The P130C determines the sign of the reactive power. If the sign is positive, a forward-directional decision is issued; if it is negative, a backward-directional decision results. A setting determines whether a trip signal is triggered by a forward-directional, a backward-directional or a non-directional decision.



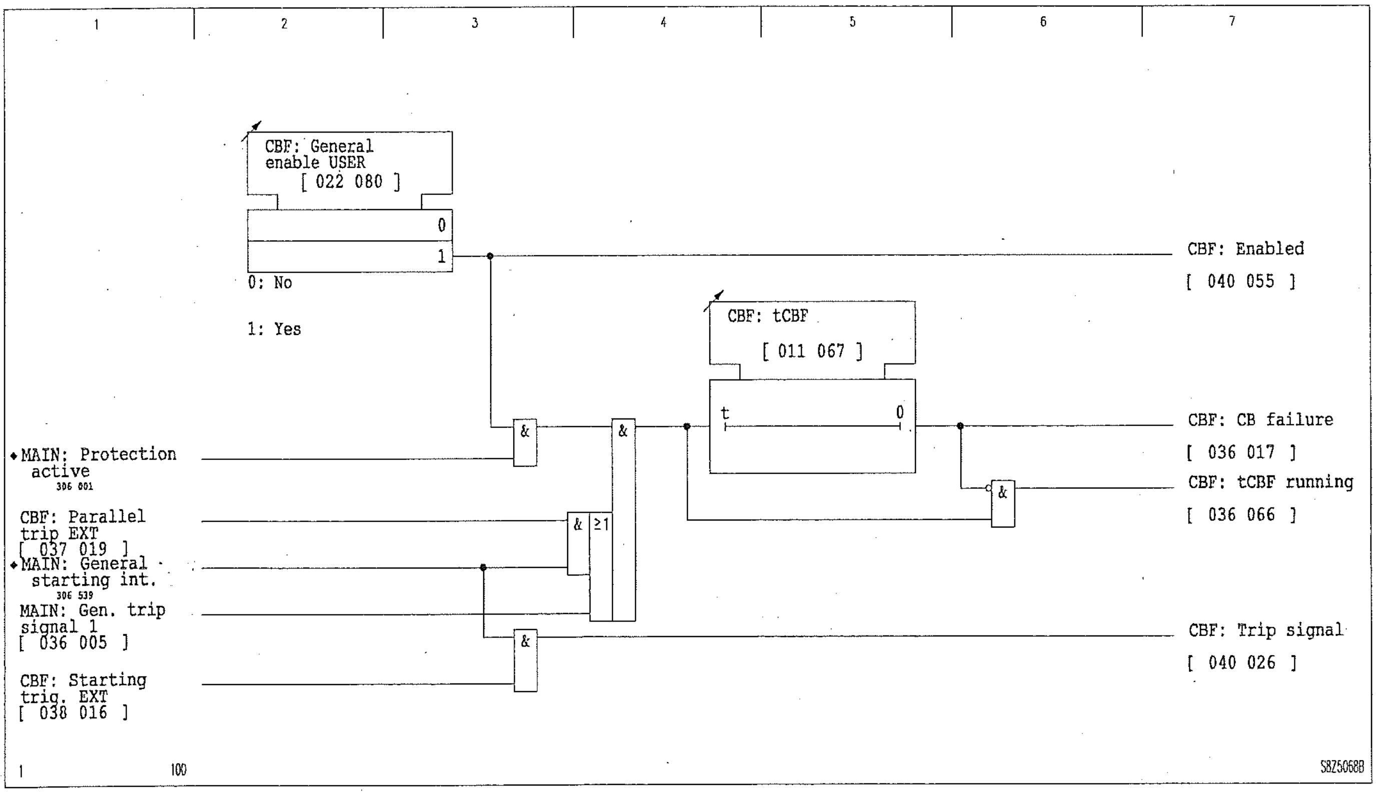
* Parameter	P<>: Direction Q> PSx	P<>: Direction Q>> PSx
set 1	017 176	017 196
set 2	017 177	017 197
set 3	017 178	017 198
set 4	017 179	017 199

3-188 *The direction-dependent trip signal of the reactive power protection function*

3.34 Circuit Breaker Failure Protection (Function Group CBF)

An adjustable timer stage for monitoring circuit breaker action is started with the general trip signal 1. This timer stage is also triggered if, in the presence of a general starting signal, a trip decision from an external protection device is acquired through a signal input. The general trip signal 2 of the P130C is not used to trigger circuit breaker failure protection. If the fault still persists when the timer stage elapses, the 'CB failure' signal is issued.

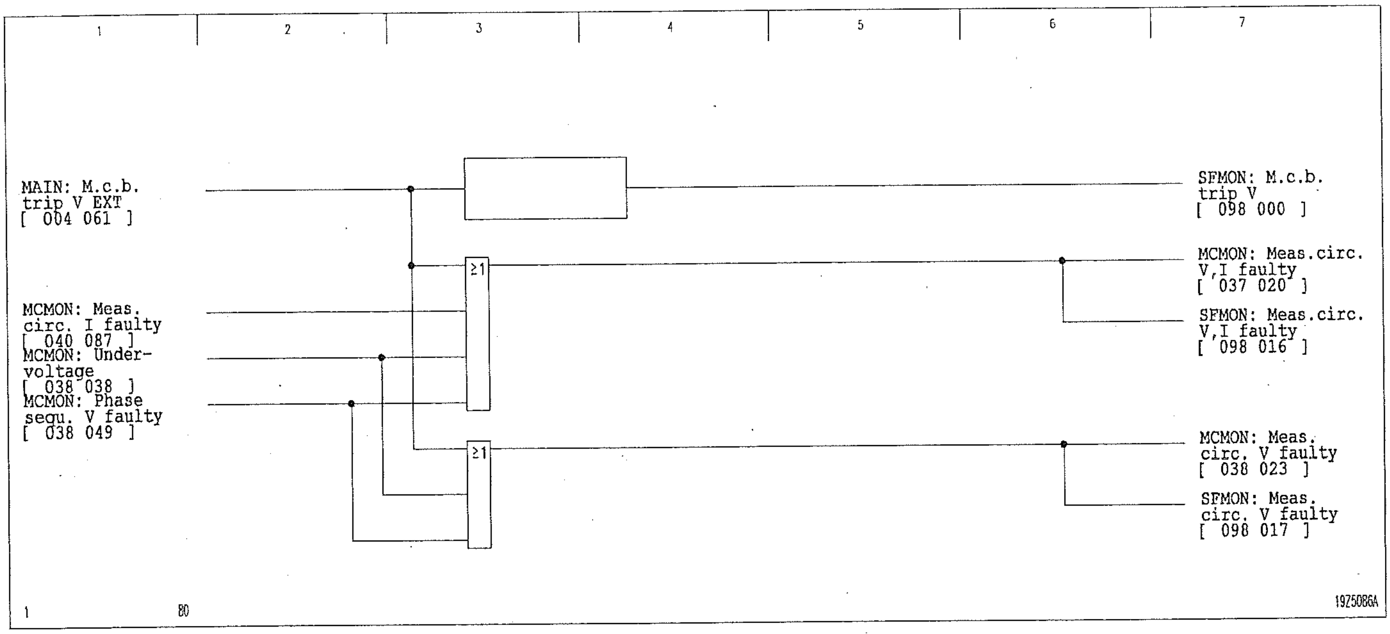
The input of a 'trip on starting' signal via an appropriately configured binary signal input generates an undelayed trip signal, provided a general starting signal is present.



3-189 *Circuit breaker failure protection*

3.35 Measuring Circuit Monitoring (Function Group MCMON)

The P130C monitors the phase currents and voltages for balance during healthy system operation. If either unbalance or the lack of measuring voltage is detected, action is taken to prevent the unit from malfunctioning.



3-190 Monitoring signals

Measuring-circuit monitoring can be deactivated by the appropriate setting. In the event of a fault, measuring-circuit monitoring is blocked.

Current monitoring

Current monitoring is only enabled if the following conditions are met simultaneously:

- ☐ Measuring-circuit monitoring is enabled.
- ☐ The difference between the maximum and the minimum phase current exceeds $0.05 \cdot I_{nom}$.
- ☐ A general starting signal is absent.

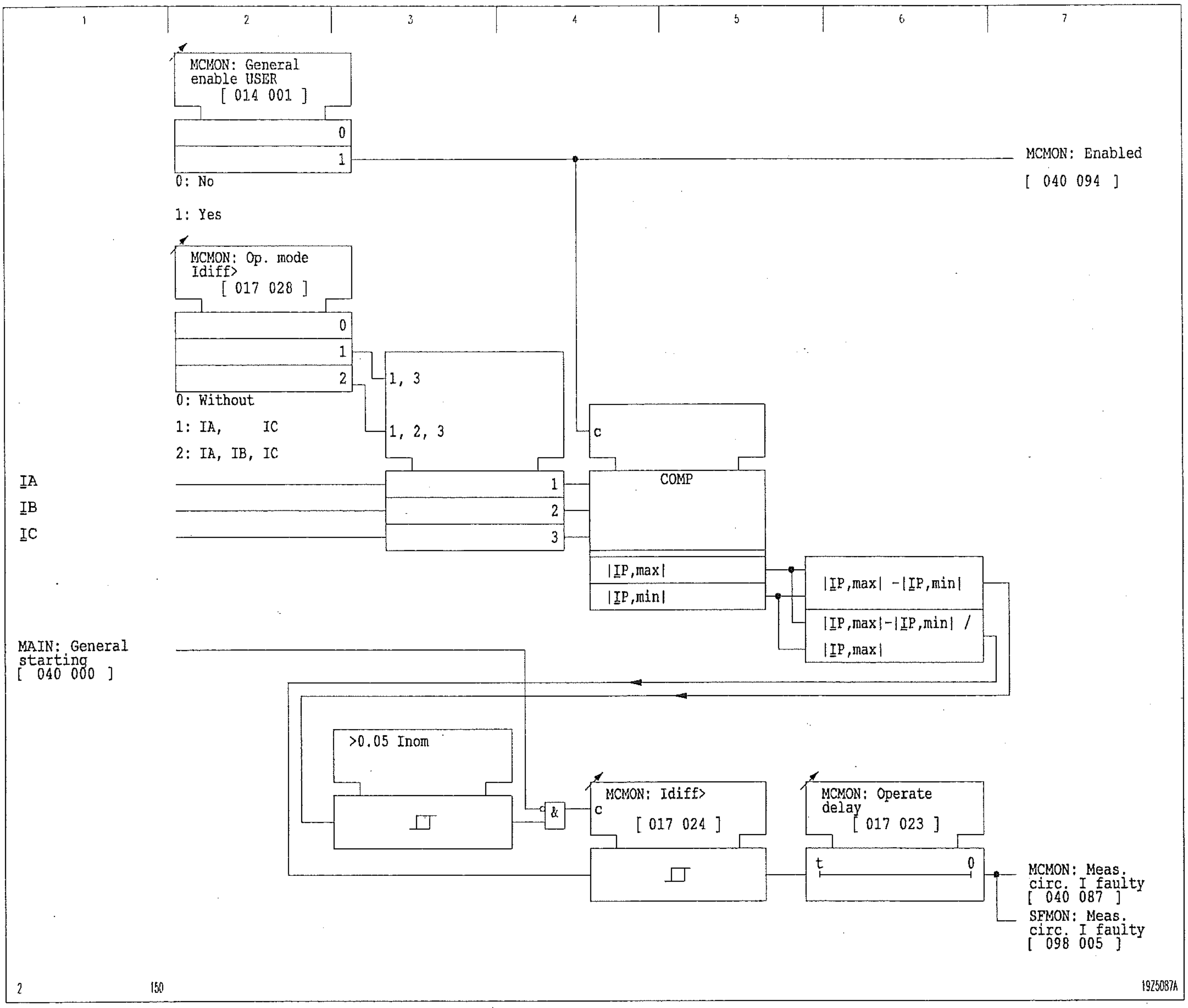
Current monitoring is based on checking the difference in the phase current magnitudes under the following operate condition:

$$\frac{I_{P,max} - I_{P,min}}{I_{P,max}} \geq I_{diff} >$$

where $I_{P,max}$ is the highest of the three phase currents and $I_{P,min}$ is the lowest; I_{diff}> is the set operate value `MCMON: Idiff>`.

In order to suppress short-term transient processes, the measuring stage I_{diff}> is followed by a set operate-delayed timer stage `MCMON: Operate delay`.

If connection is to two current transformers only (in resonant-grounded systems, for example) evaluation of current I_A can be disabled by an appropriate selection for the operating mode.



3-191 Monitoring the current-measuring circuits

Voltage monitoring

Voltage monitoring is only enabled if the following conditions are met simultaneously:

- ☐ Measuring circuit monitoring is enabled.
- ☐ A general starting signal is absent.

In addition to these conditions, either a minimum current having the default threshold setting of $I > 0.05 \cdot I_{nom}$ or the closed position of the circuit breaker can be used as enabling criteria. If at least one of the phase-to-phase voltages falls below the set trigger value MCMON: Vmin< for the period of the operate-delayed timer stage MCMON: Operate delay, then the MCMON: Undervoltage signal is generated.

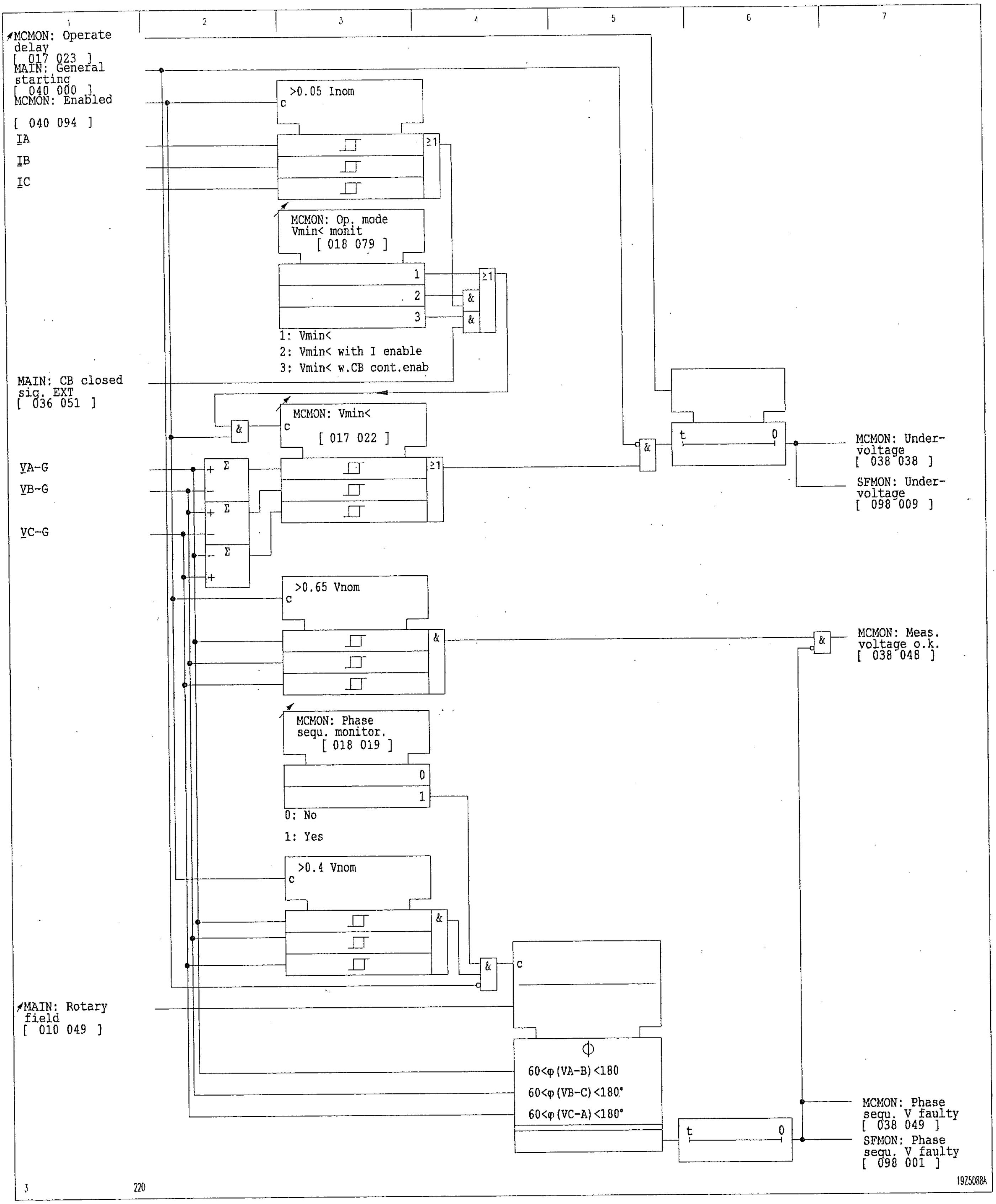
The signal MCMON: Meas. voltage o.k. is generated if all three phase-to-phase voltages exceed the fixed threshold of 0.65 V_{nom} and there is no incorrect phase sequence.

Phase-sequence monitoring

Phase-sequence monitoring is enabled if the following conditions are met simultaneously:

- ☐ Measuring circuit monitoring is enabled.
- ☐ Phase-sequence monitoring is activated.
- ☐ All three phase-to-ground voltages exceed $0.4 \cdot V_{nom}$.
- ☐ A general starting signal is absent.

In order to suppress short-term transient processes, the phase-sequence monitoring trigger is followed by a set operate delay of 1 s. Once the operate delay has elapsed, the signal MCMON: Phase sequence faulty is generated.



3-192 *Monitoring the voltage-measuring circuits*

3.36 Limit Value Monitoring (Function Group LIMIT)

Disabling or enabling limit value monitoring

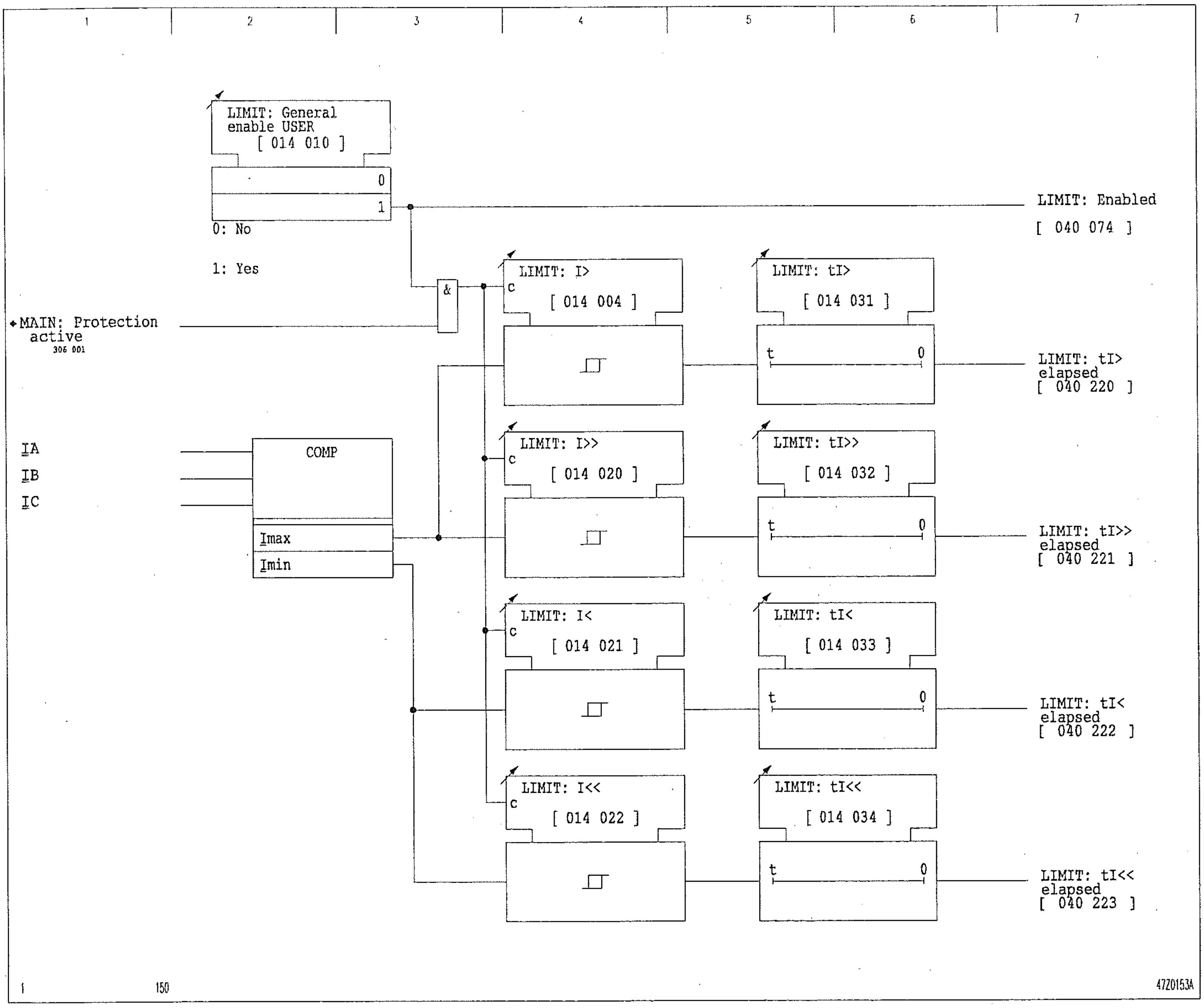
Limit value monitoring can be disabled or enabled from the integrated local control panel.

Monitoring phase currents and phase voltages

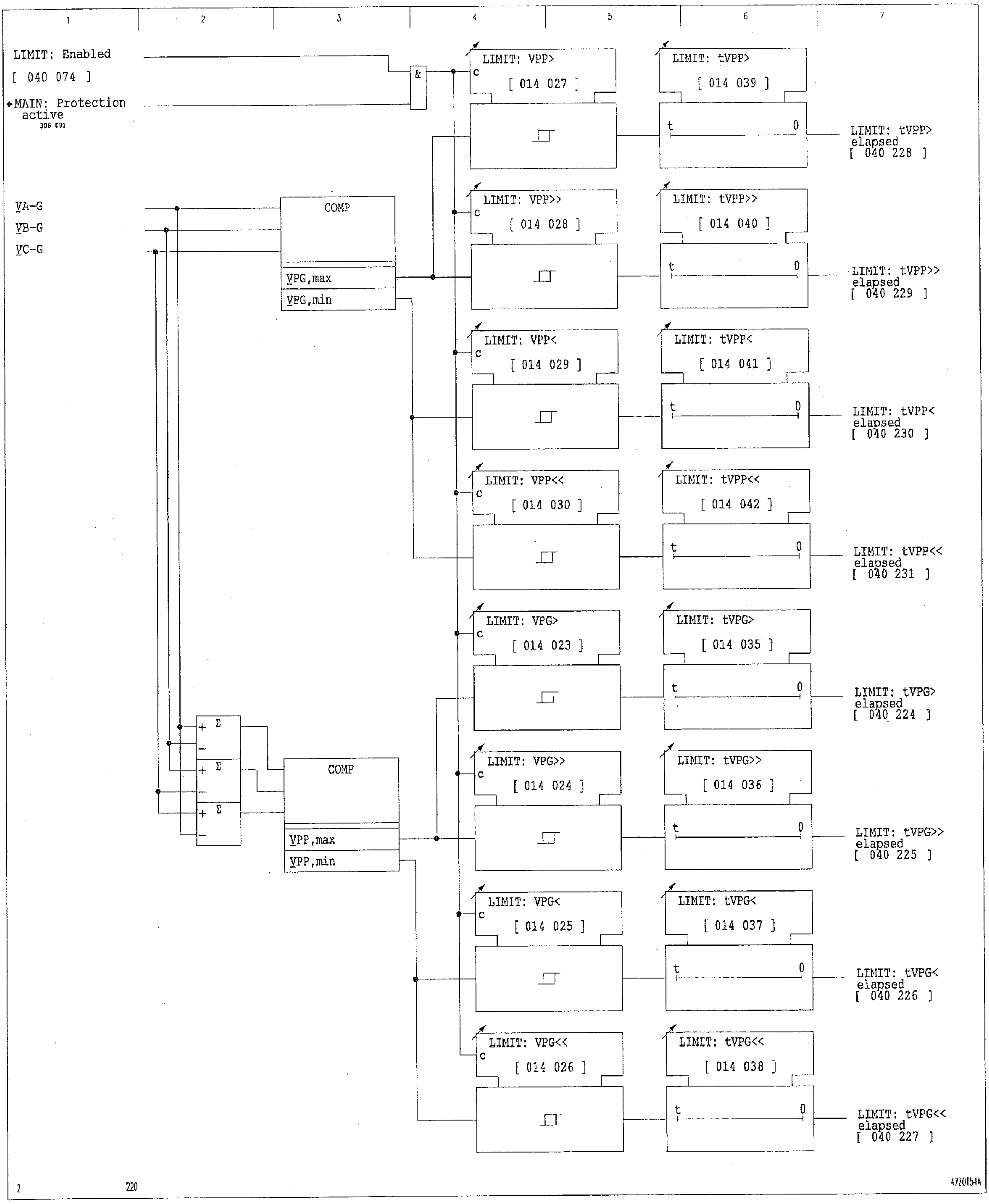
The P130C offers the possibility of monitoring the following measured values to determine if they exceed a set upper limit value or fall below a set lower limit value:

- Maximum phase current
- Minimum phase current
- Maximum phase-to-phase voltage
- Minimum phase-to-phase voltage
- Maximum phase-to-ground voltage
- Minimum phase-to-ground voltage

If one of the measured values exceeds or falls below one of the set upper or lower limit values, respectively, then a signal is issued once a set time period has elapsed.



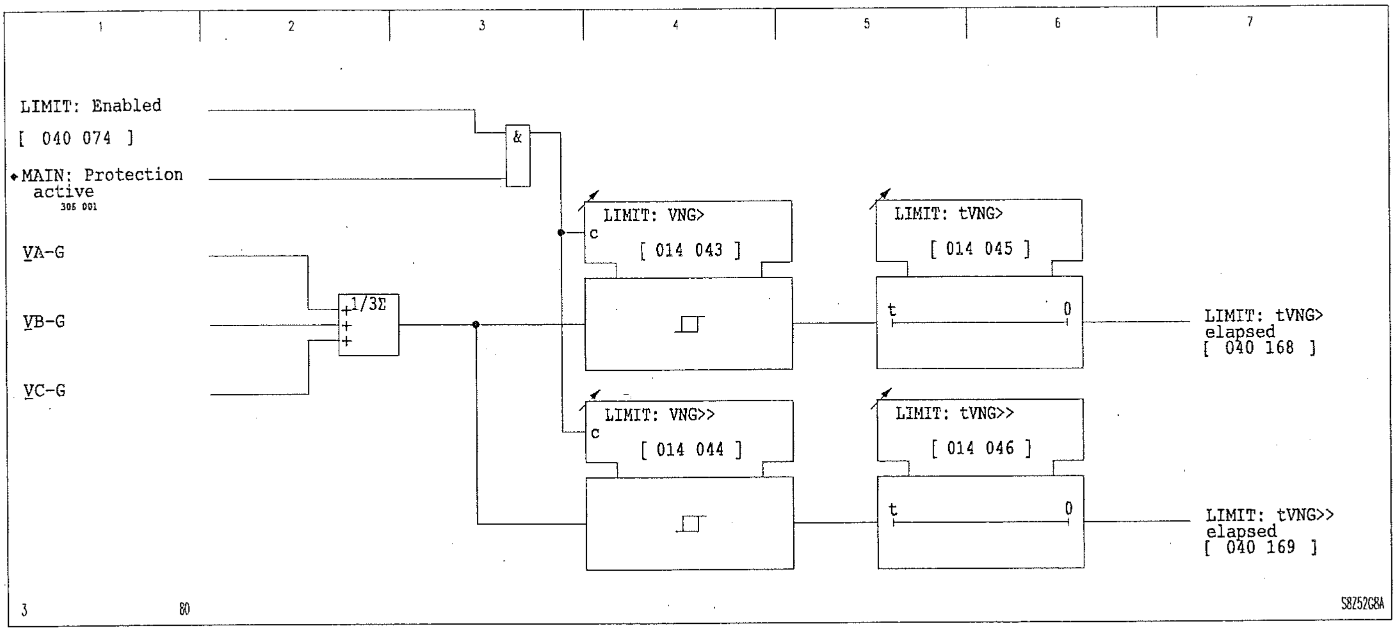
3-193 Limit value monitoring of minimum and maximum phase current



3-194 Limit value monitoring of maximum and minimum phase-to-phase voltage and maximum and minimum phase-to-ground voltage

Monitoring the neutral-displacement voltage

The neutral-displacement voltage calculated from the three phase-to-ground voltages is monitored by two stages to determine whether it exceeds set thresholds. If the thresholds are exceeded, a signal is issued after the set timer stage has elapsed.



3-195 *Monitoring the neutral-displacement voltage*

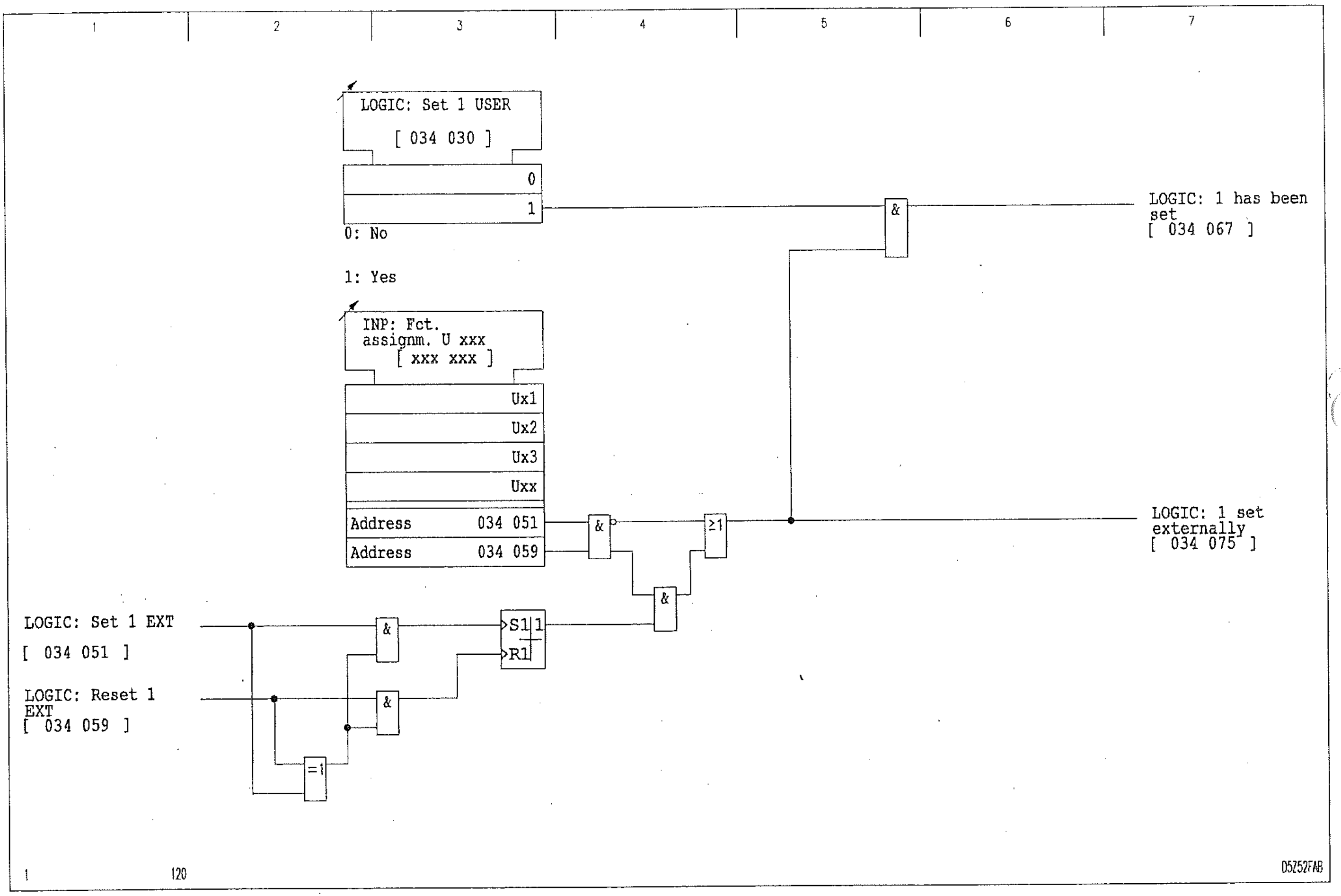
3.37 Programmable Logic (Function Group LOGIC)

Programmable (or user-configurable) logic enables the user to link binary signals within a framework of Boolean equations.

Binary signals in the P130C can be linked by logical 'OR' or 'AND' operations with the option of additional NOT operations by setting LOGIC: Fct. assignm. outp. n, where n = 1 to 32. The Boolean equations need to be defined without the use of brackets. The following rule applies to the operators: 'NOT' before 'AND' before 'OR'.

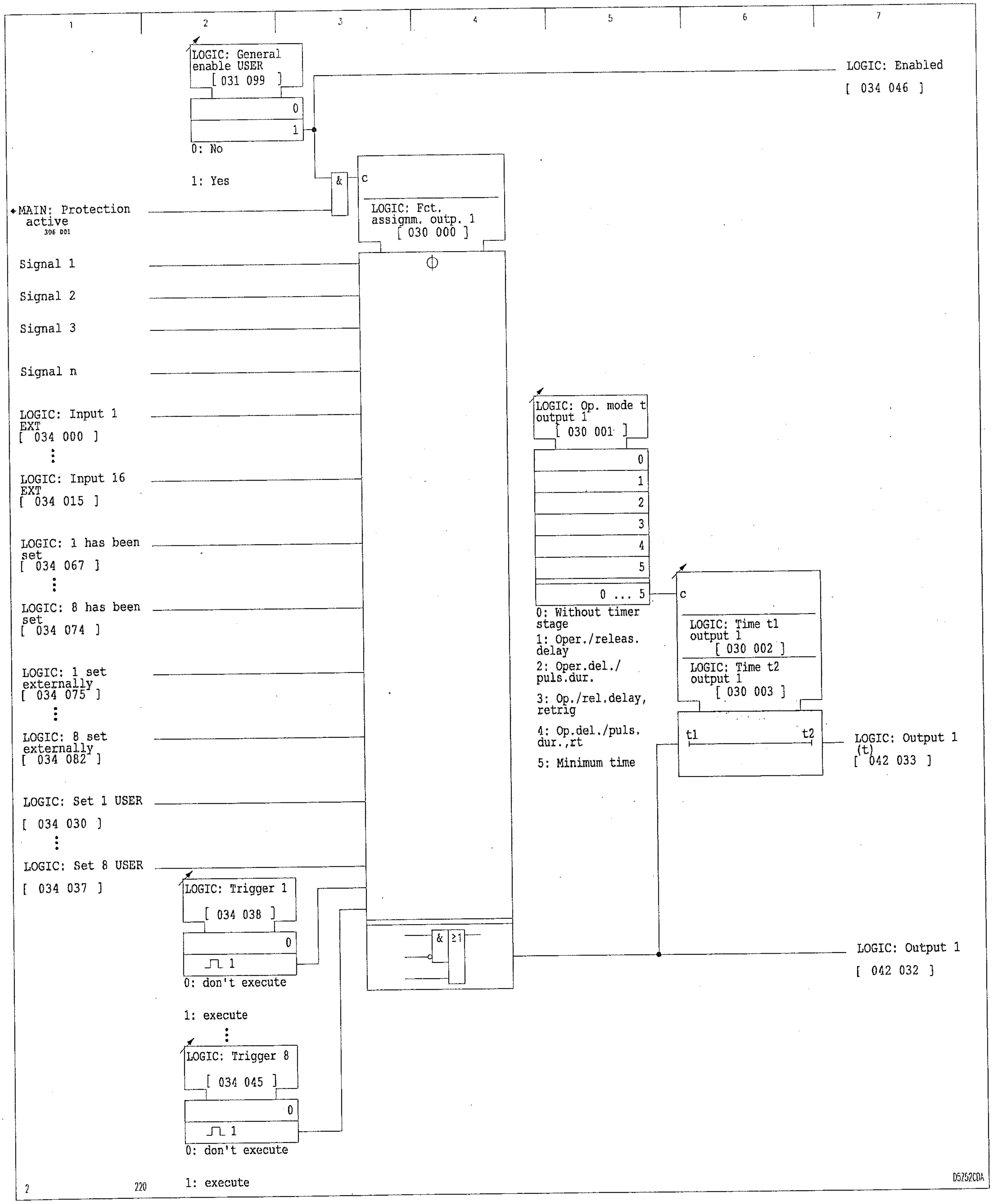
A maximum of 32 elements can be processed in one Boolean equation. In addition to the signals generated by the P130C, initial conditions for governing the equations can be set from the local control panel, through binary signal inputs, or through the serial interfaces.

Logical operations can be controlled through the binary signal inputs in different ways. The binary input signals LOGIC: Input n EXT (n = 1 to 16) have an updating function, whereas the input signals LOGIC: Set n EXT (n = 1 to 8) are stored. The logic can only be controlled from the binary signal inputs that are configured for LOGIC: Set n EXT if the corresponding reset input (LOGIC: Reset n EXT) has also been configured for a binary signal input. If only one or neither of the two functions is configured, then this is interpreted as 'Logic externally set'. If the input signals of the two binary signal inputs are implausible (such as when they both have a logic value of '1'), then the last plausible state remains stored in memory.



3-196 *Control of logic operations via setting parameters or stored input signals*

The LOGIC: Trigger n signal is a 'triggering function' that causes a 100 ms pulse to be issued.

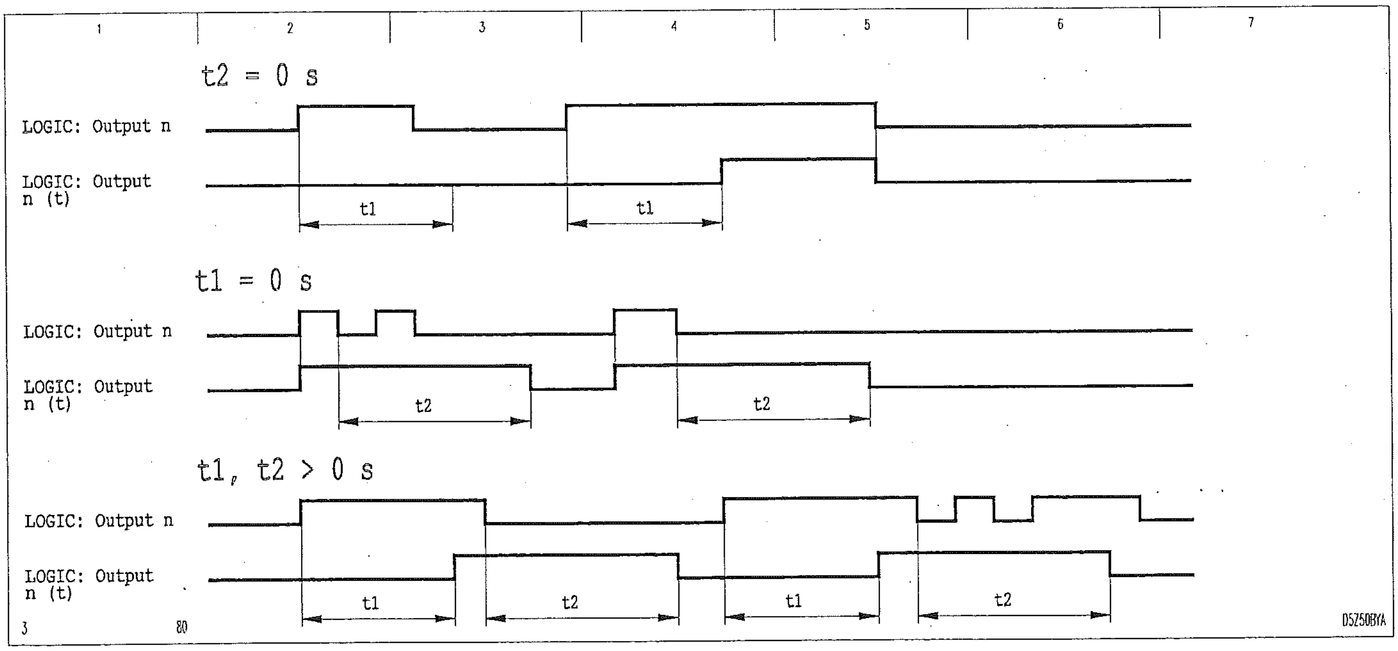


3-197 *Setting options for programmable logic (shown here for output 1)*

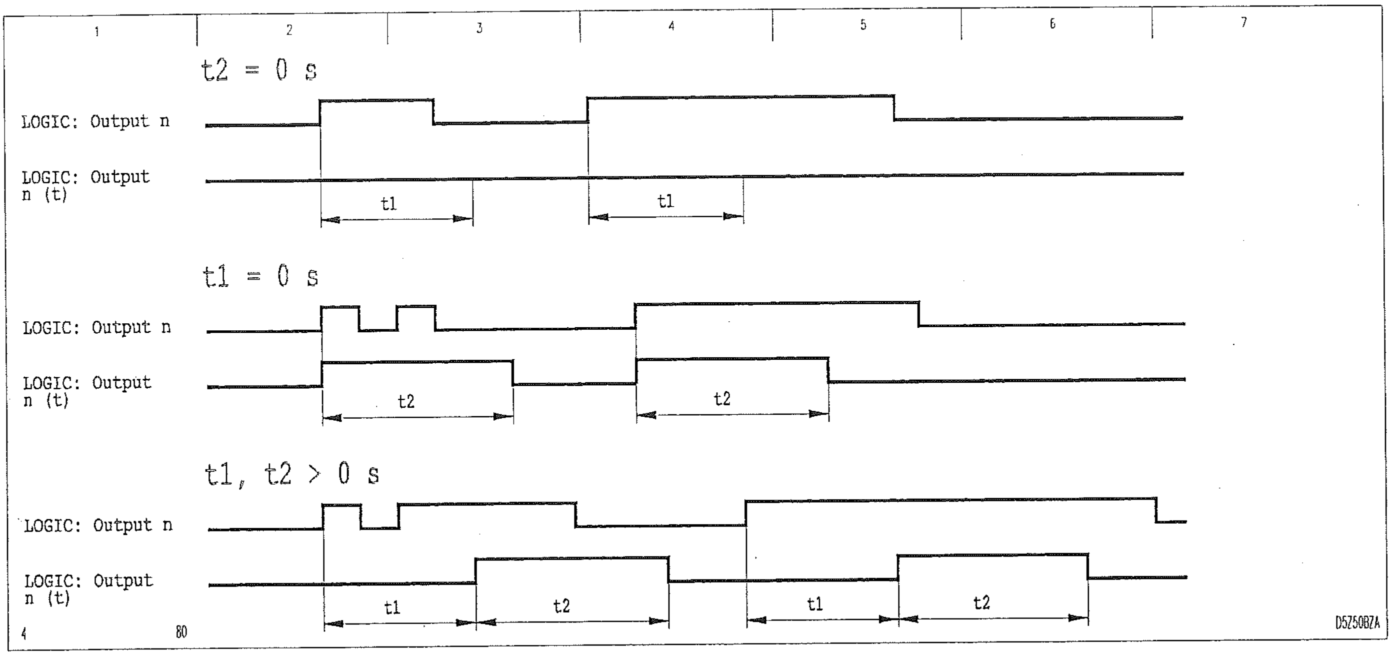
The output signal of one equation can be processed as the input signal for another, higher-order, equation and this makes it possible to have a sequence of interlinked Boolean equations. The equations are processed in the sequence defined by the order of each equation so that the end result of a sequence of interlinked Boolean equations is given by the highest-order equation.

The output signal of each equation is fed to a separate timer stage with two timer elements and a choice of operating modes. This offers the possibility of assigning a freely configurable time characteristic to the output signal of each Boolean equation. In the *Minimum time* operating mode, the setting of timer stage t2 has no effect. Figures 3-198 to 3-202 show the time characteristics for the various timer stage operating modes.

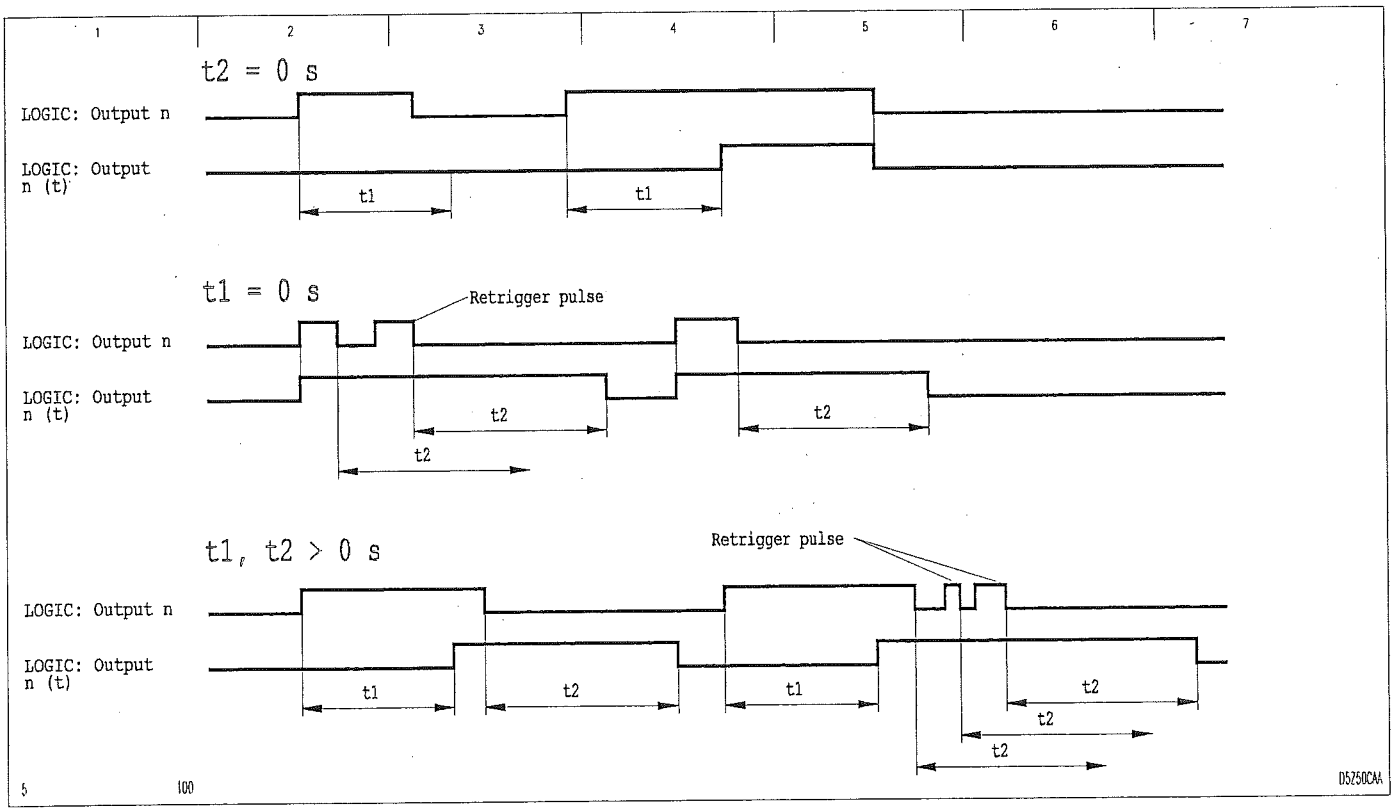
Note: If the unit is set to "off-line", the equations are not processed and all outputs are set to a logic value of '0'.



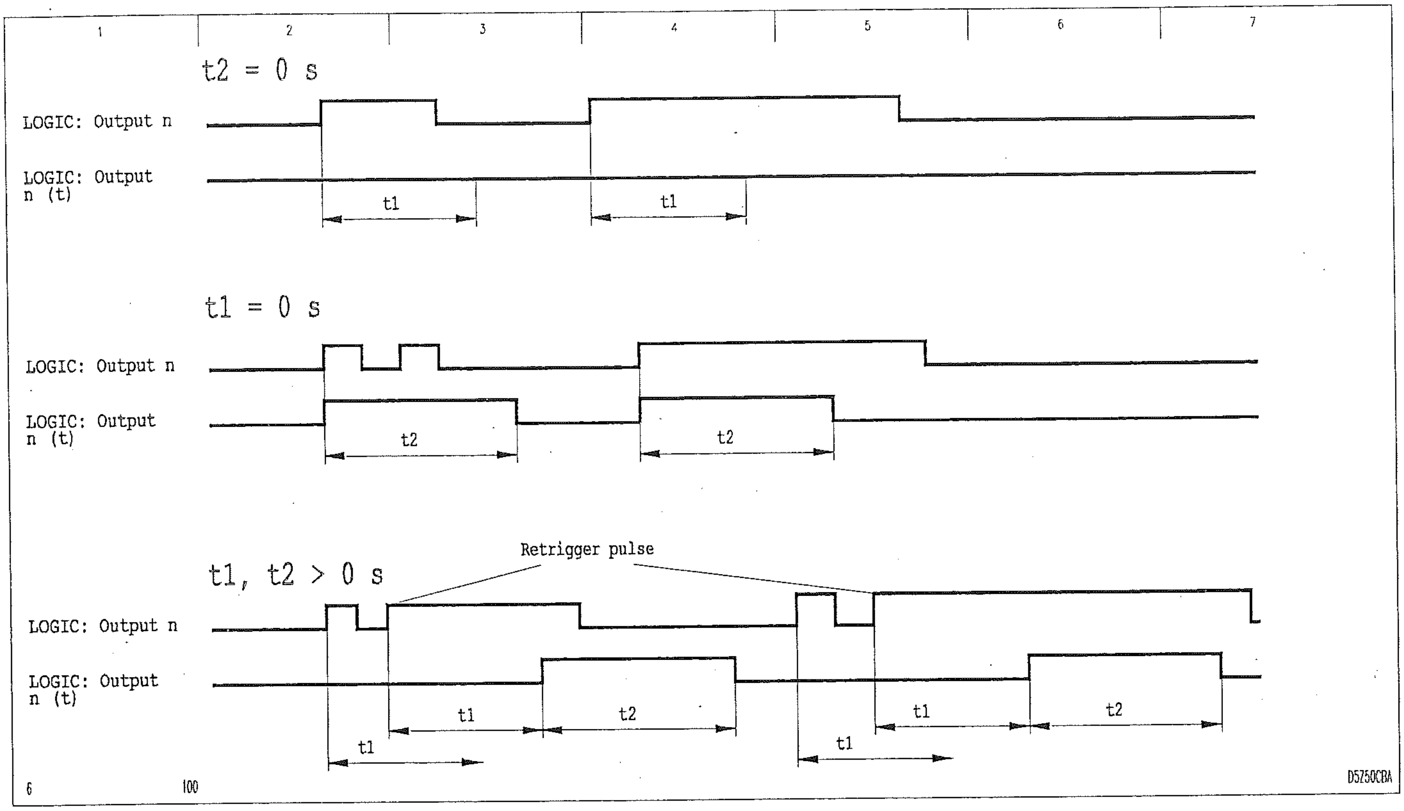
3-198 *Operating mode 1: Operate/release delay*



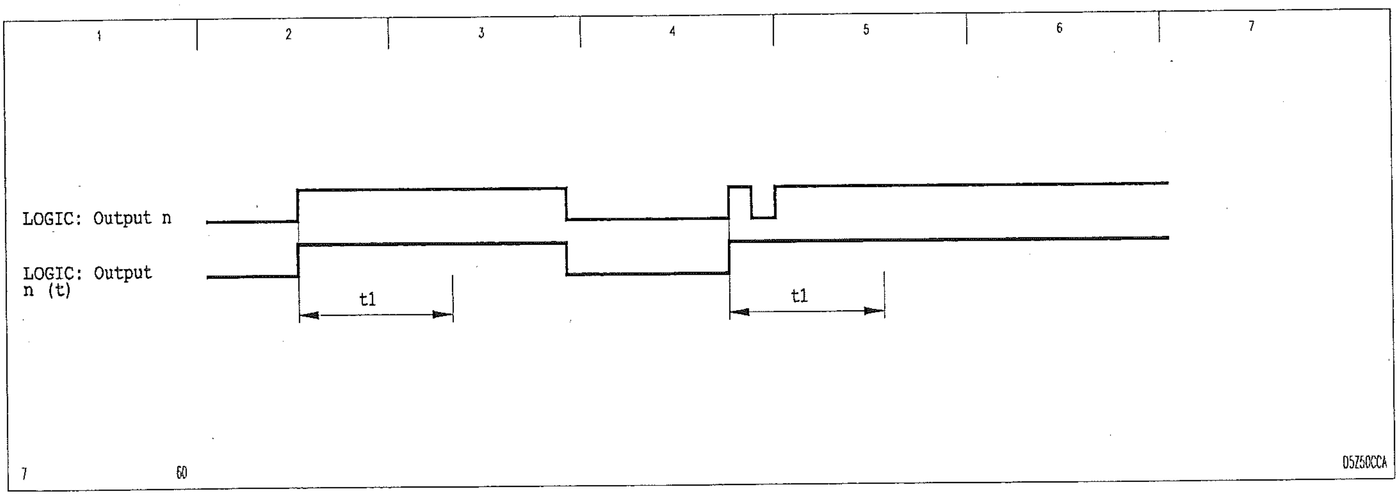
3-199 *Operating mode 2: Operate-delay/pulse duration*



3-200 *Operating mode 3: Operate/release delay, retriggerable*

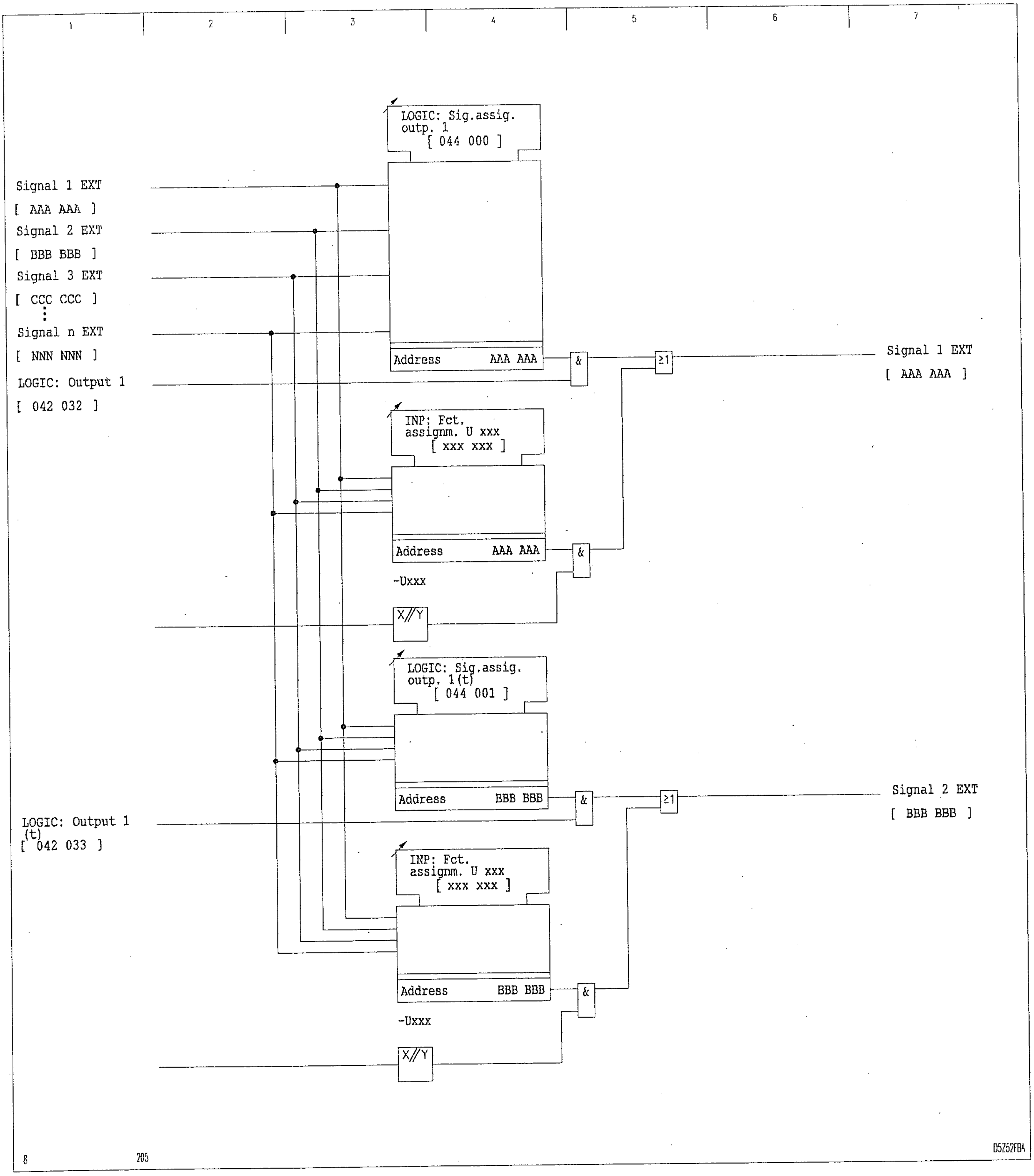


3-201 *Operating mode 4: Operate-delay/pulse duration, retriggerable*



3-202 *Operating mode 5: Minimum time*

Through appropriate configuration, it is possible to assign the function of a binary input signal to each output of a logic operation. The output of the logic operation then has the same effect as if the binary signal input to which this function has been assigned were triggered.



3-203 Signal assignment to outputs of Boolean equations

4 Design

The P130C is mounted in an aluminum case. Connection is via threaded terminal ends. The case is suitable for either wall-surface mounting or flush panel-mounting. The mounting brackets adjust for flush mounting.

Figures 4-1 and 4-2 show the case dimensions and mounting dimensions. A cover frame is supplied for flush mounting (see Installation and Connection).

Regardless of model, the P130C - like all other device types in the MiCom Px30 system - is equipped with the standard local control panel. The local control panel is covered with a tough film so that the specified degree of protection will be maintained. In addition to the essential control and display elements, a parallel display consisting of a total of 17 LED indicators is also incorporated into the local control panel. The meaning of the various LED indications is shown in plain text on a label strip.

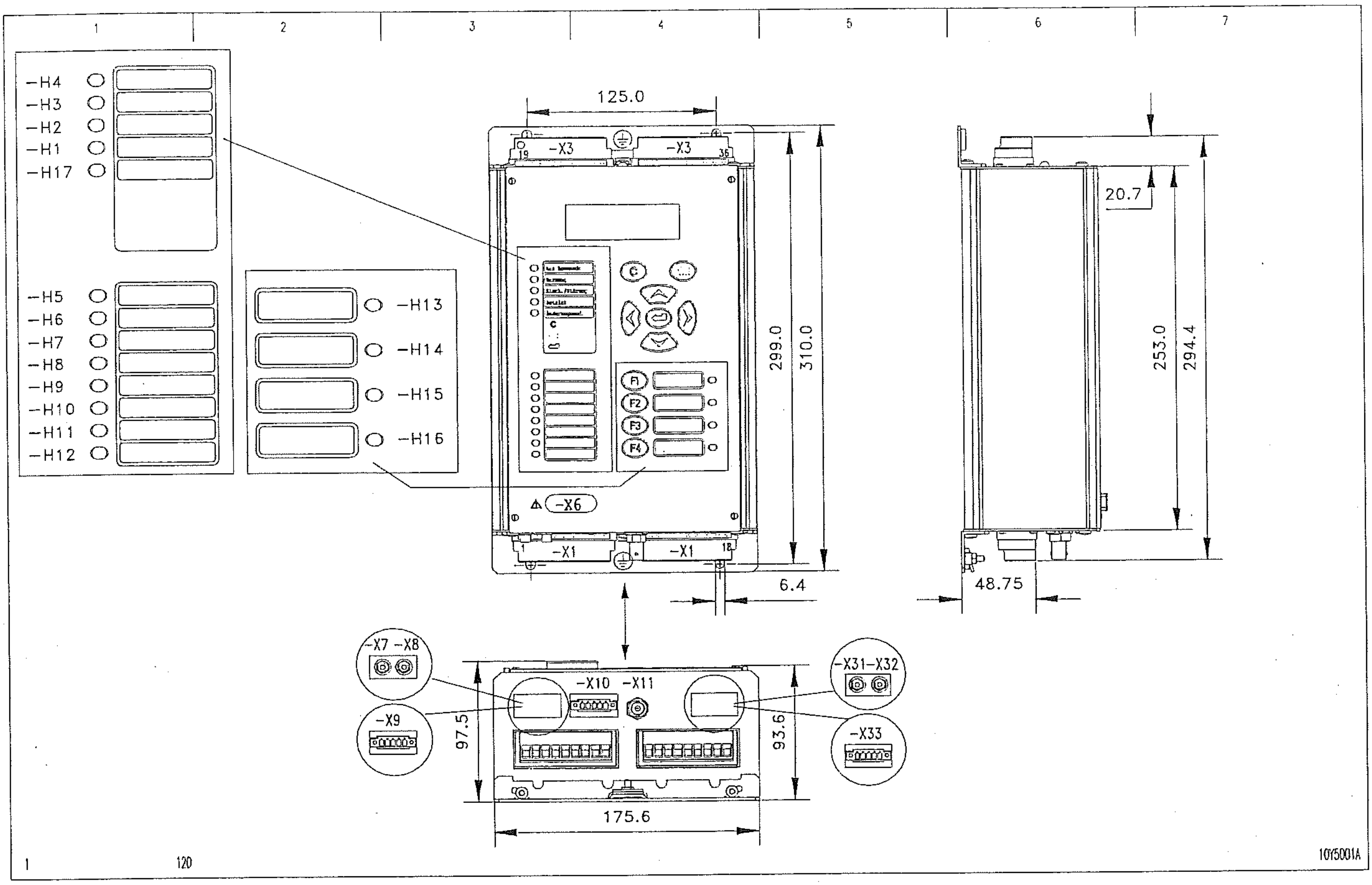
The components located behind the front panel are energized. Therefore always turn off the supply voltage before opening the device.

The processor module with the local control module is attached to the reverse side of the removable front plate and connected to the combined I/O module via a ribbon cable. The I/O module incorporates the power supply, the optional input transformers, the output relays and optical couplers for binary input signals.

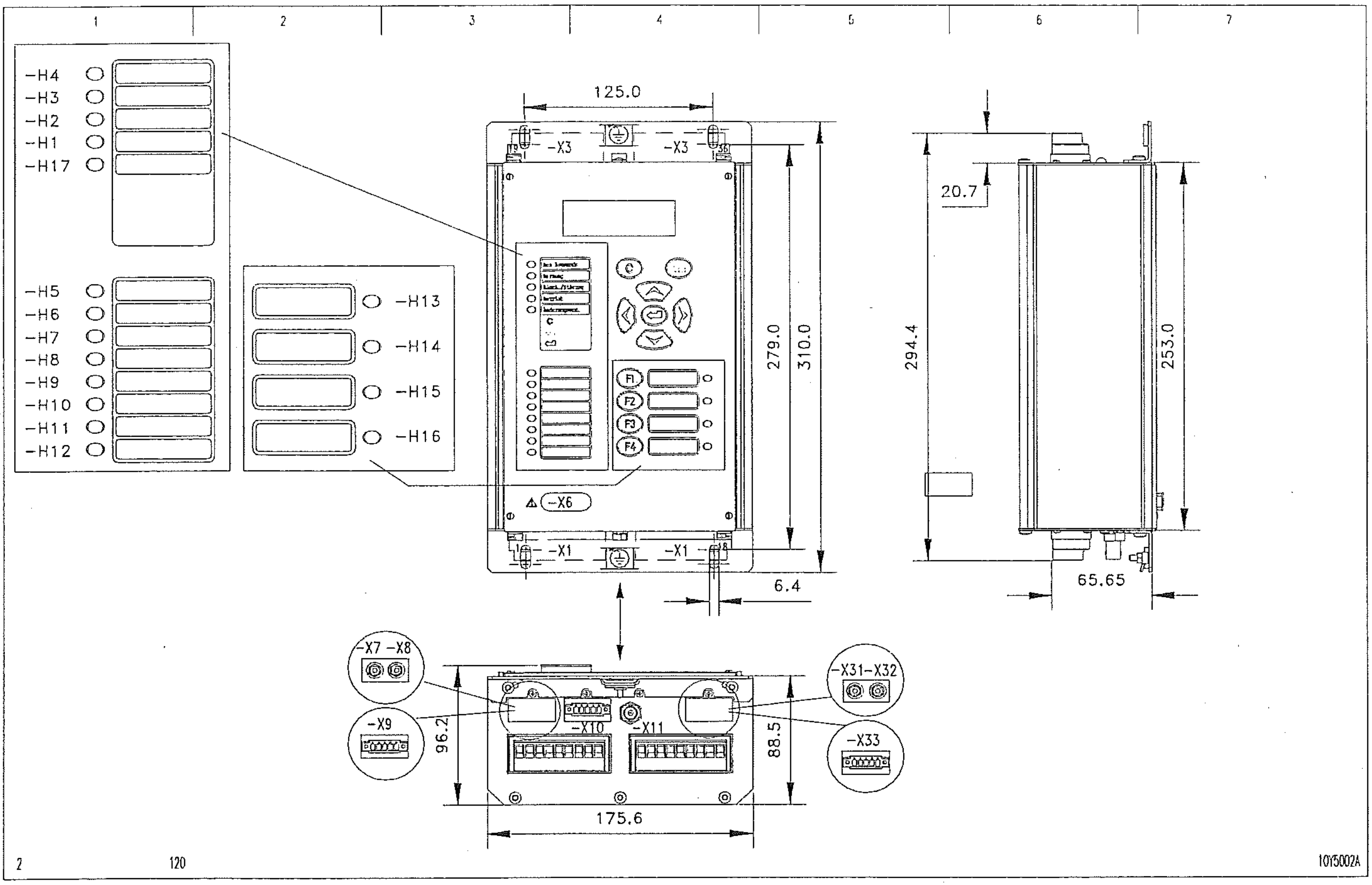
The secondary circuit of operating current transformers must not be opened. If the secondary circuit of an operating current transformer is opened, there is the danger that resulting voltages may injure personnel or damage the insulation.

The threaded terminal block for current transformer connection is not a shorting block. Therefore always short-circuit the current transformer before loosening the threaded terminals.

The front panel houses the -X6 serial interface for parameter setting by way of a PC. The optional communication interfaces (-X7 and -X8 or -X9 and -X10) and the optional IRIG-B input (-X11) are located on the underside of the case.



4-1 *Dimensional drawing of the wall-mounting case (-X7 and -X8 or -X9 and -X10: optional communication interfaces; -X11: optional IRIG input; -X31 and -X32: optional InterMiCOM interface for connection to optical fiber, X33: optional InterMiCOM interface for connection to wire)*



4-2 Dimensional drawing of the flush-mounting case (-X7 and -X8 or -X9 and -X10: optional communication interfaces; -X11: optional IRIG input; -X31 and -X32: optional InterMiCOM interface for connection to optical fiber, X33: optional InterMiCOM interface for connection to wire)

5 Installation and Connection

5 Installation and Connection

5.1 Unpacking and Packing

All P130C units are packaged separately in their own cartons and shipped inside outer packaging. Use special care when opening cartons and unpacking units, and do not use force. In addition, make sure to remove the supporting documents supplied with each individual unit from the inside carton.

After unpacking each unit, inspect it visually to make sure it is in proper mechanical condition.

If the P130C needs to be shipped, both inner and outer packaging must be used. If the original packaging is no longer available, make sure that packaging conforms to DIN ISO 2248 specifications for a drop height ≤ 0.8 m.

5.2 Checking the Nominal Data and the Design Version

The nominal data and design version of the P130C can be determined by consulting the type identification label (see Figure 5-1). One type identification label is located next to the upper terminal blocks. Another copy of the type identification label is affixed to the outside of the P130C packaging.

P130C	P130C-XXXXXXX-301-401-601			Diagram P130C.401		xx.yy
$U_{nom / NE,nom}$ = 50 ... 130 V	I_{nom} = 1 / 5 A	$I_{E,nom}$ = 1 / 5 A	$I_{EP,nom}$ = A		f_{nom} = 50/60 Hz	
$U_{H,nom}$ =		$U_{E,nom}$ = 24 ... 250 V DC				CE
ALSTOM Made in Germany	Specification EN 60255-6 / IEC 255-6		F 6.xxxxxx.y			

5-1 *P130C type identification label*

The data shown on the type identification label include the nominal auxiliary voltage $V_{A,nom}$ ('$U_{H,nom}$') and the nominal input voltage $V_{in,nom}$ ('$U_{E,nom}$').

The P130C design version can be determined from the order number. A breakdown of the order number is given in Chapter 14 of this manual and in the supporting documents supplied with the unit.

5.3 Location Requirements

The P130C has been designed to conform to EN 69255-6. Therefore it is important when choosing the installation location to make sure that it provides the conditions specified in the chapter entitled 'Technical Data'. Several important conditions are listed below.

Climatic conditions

Ambient temperature:	-5 °C to +55 °C [+23 °F to +131 °F]
Air pressure:	800 to 1100 hPa
Relative humidity:	The relative humidity must not result in the formation of either condensed water or ice in the P130C.
Ambient air:	The ambient air must not be significantly polluted by dust, smoke, gases or vapors, or salt.

Mechanical conditions

Vibration stress:	10 to 60 Hz, 0.035 mm and 60 to 150 Hz, 0.5 g
Earthquake resistance:	5 to 8 Hz, 3.5 mm / 1.5 mm, 8 to 35 Hz, 5 m/s^2, 3 x 1 cycle

Electrical conditions for auxiliary voltage for the power supply

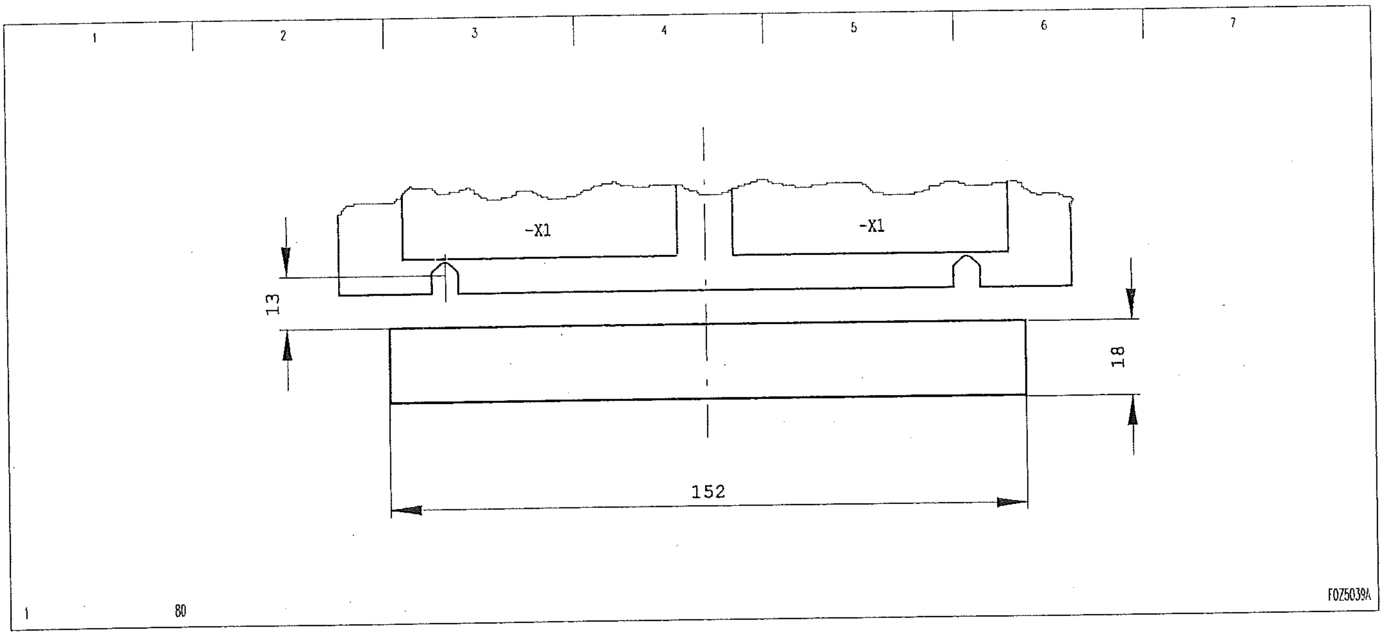
Operating range:	0.8 to 1.1 $V_{A,nom}$ with a residual ripple of up to 12 % $V_{A,nom}$

Electromagnetic conditions

Appropriate measures taken in substations must correspond to the state of the art (see, for example, the VDEW ring binder entitled "Schutztechnik" [Protective Systems], Section 8, June 1992 edition, which includes recommended measures for reducing transient overvoltage in secondary lines in high voltage substations).

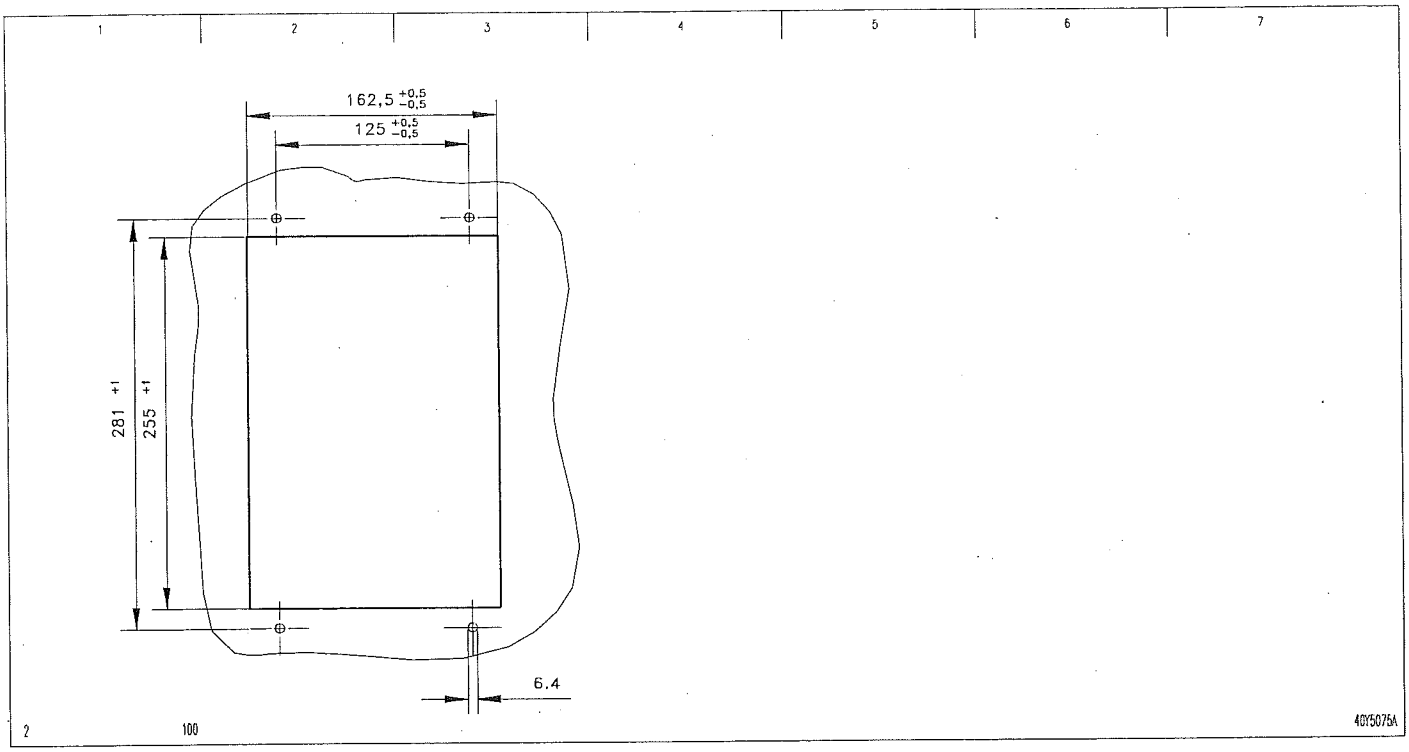
5.4 Installation

The dimensions and mounting dimensions for surface-mounted cases are given in Chapter 4. When the P130C is surface-mounted on a panel, the leads to the P130C are normally run along the front side of the mounting plane. If the wiring is to be in back, an opening can be provided above and below the surface-mounted case, as shown in Figure 5-2 for the lower opening. The same applies analogously to the upper opening.

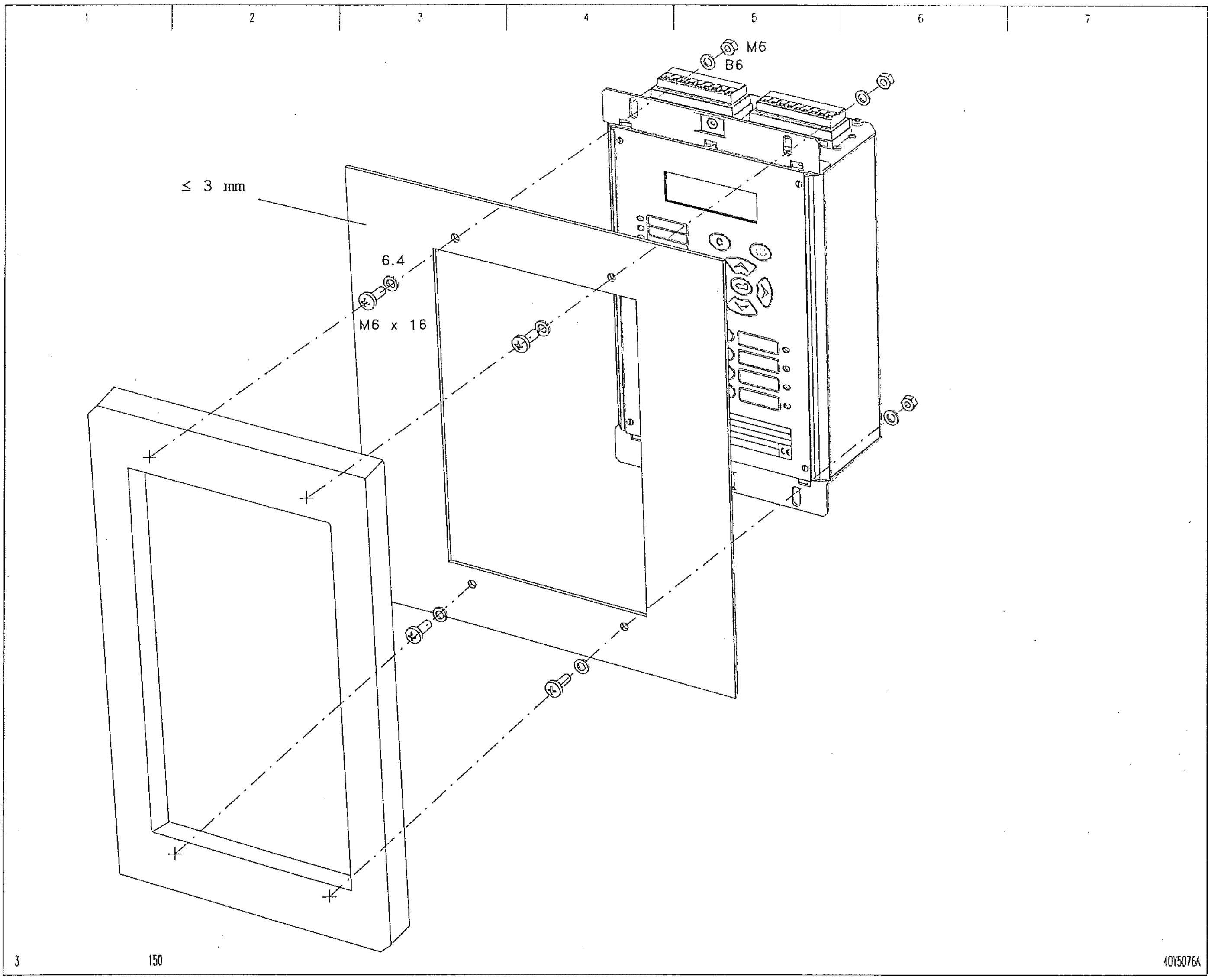


5-2 *Opening for running the connecting leads to the surface-mounted case (dimensions in mm)*

Flush-mounted cases are designed to be flush-mounted in control panels. The dimensions and mounting dimensions are given in Chapter 4. When the P130C is mounted in a cabinet door, special sealing measures are necessary to provide the degree of protection required for the cabinet (IP 51). Figure 5-3 shows the required panel cutout for the flush-mounted case. After the case has been mounted, the cover frame must be snapped onto the mounting bolts of the flush-mounted case (see Figure 5-4) in order to maintain the required degree of protection.



5-3 *Panel cutout for the flush-mounted case (dimensions in mm)*



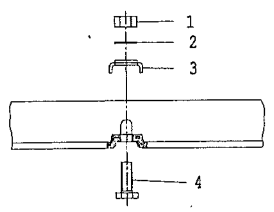
5-4 *Installation of the flush-mounted case*

5.5 Protective Grounding

The unit must be reliably grounded to meet protective equipment grounding requirements. The case is grounded using the appropriate bolt and nut as the ground connection. The cross-sectional area of this ground conductor must also conform to applicable national standards. A minimum conductor cross section of 2.5 mm^2 is required.

In addition, a protective ground connection at the terminal contact on the power supply module (identified by the letters "PE" on the terminal connection diagram) is also required for proper operation of the unit. The cross-sectional area of this ground conductor must also conform to applicable national standards. A minimum cross section of 1.5 mm^2 is required.

The grounding connection at both locations must be low-inductance, i.e., as short as possible.



PE terminal	
Pos.	Description
1	Nut M4
2	Tooth lock wash.A4.3
3	Clamp bracket
4	Bolt M4

5-5 *Mounting the PE terminal*

5.6 Connection

The P130C must be connected in accordance with the terminal connection diagram indicated on the type identification label. The terminal connection diagram is included in the Supporting Documents supplied with the unit. The terminal connection diagrams that apply to the P130C are also found in the appendix to this manual.

Copper leads having a 2.5-mm^2 cross-section are generally suitable as the connecting leads between the current transformers and the P130C. Under certain conditions the connecting leads between the main current transformers and the P130C must be short and have a larger cross-section in order to handle the allowable burden on the main current transformers. Copper leads having a 1.5 mm^2 cross section are adequate for connecting the binary signal inputs, the signaling and triggering circuits, and the power supply input.

All connections run into the system must always have a defined potential. Connections that are pre-wired but not used should preferably be grounded when binary inputs and output relays are isolated. When binary inputs and output relays are connected to common potential, the pre-wired but unused connections should be connected to the common potential of the grouped connections.

5.6.1 Connecting the Measuring and Auxiliary Circuits

Power supply

Before connecting the auxiliary voltage V_A for the P130C power supply, make sure that the nominal value of the auxiliary device voltage agrees with the nominal value of the auxiliary system voltage.

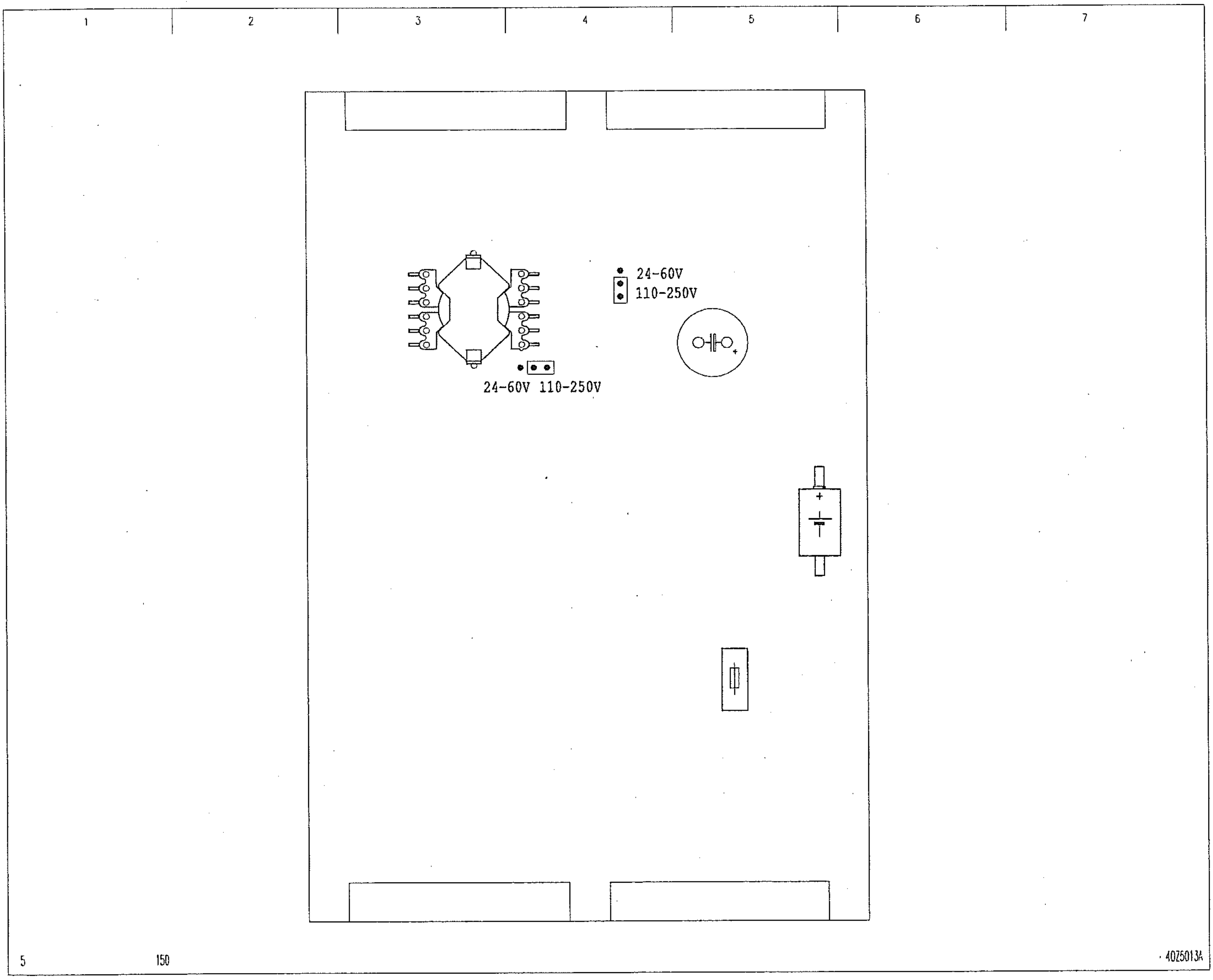
The P130C has an auxiliary voltage supply that can be switched between ranges and is factory-set for the voltage range of $V_{A,nom}$ = 110 to 250 V DC or 100 to 230 V AC.

Before changing the auxiliary voltage range, turn off any connected auxiliary voltage. The components located behind the front panel are energized!

The voltage range is switched by repositioning plug-in jumpers on the I / O (input-output) module. After loosening four bolts on the front side of the front panel the local control module (front panel and processor module), can be removed once the following connectors have been unplugged:

- ☐ The ribbon cable plug connecting the local control module to the I / O module
- ☐ The ribbon cable plug connecting the local control module to the optional serial communication interfaces (to optical fibers or to wires)

In the upper portion of the I / O module, between output relay and current input transformers, are plug-in jumpers, which are plugged in a position depending on the desired auxiliary voltage range.



5-6 *Switching the auxiliary voltage supply. The factory-set jumper position is shown.*

Current-measuring inputs

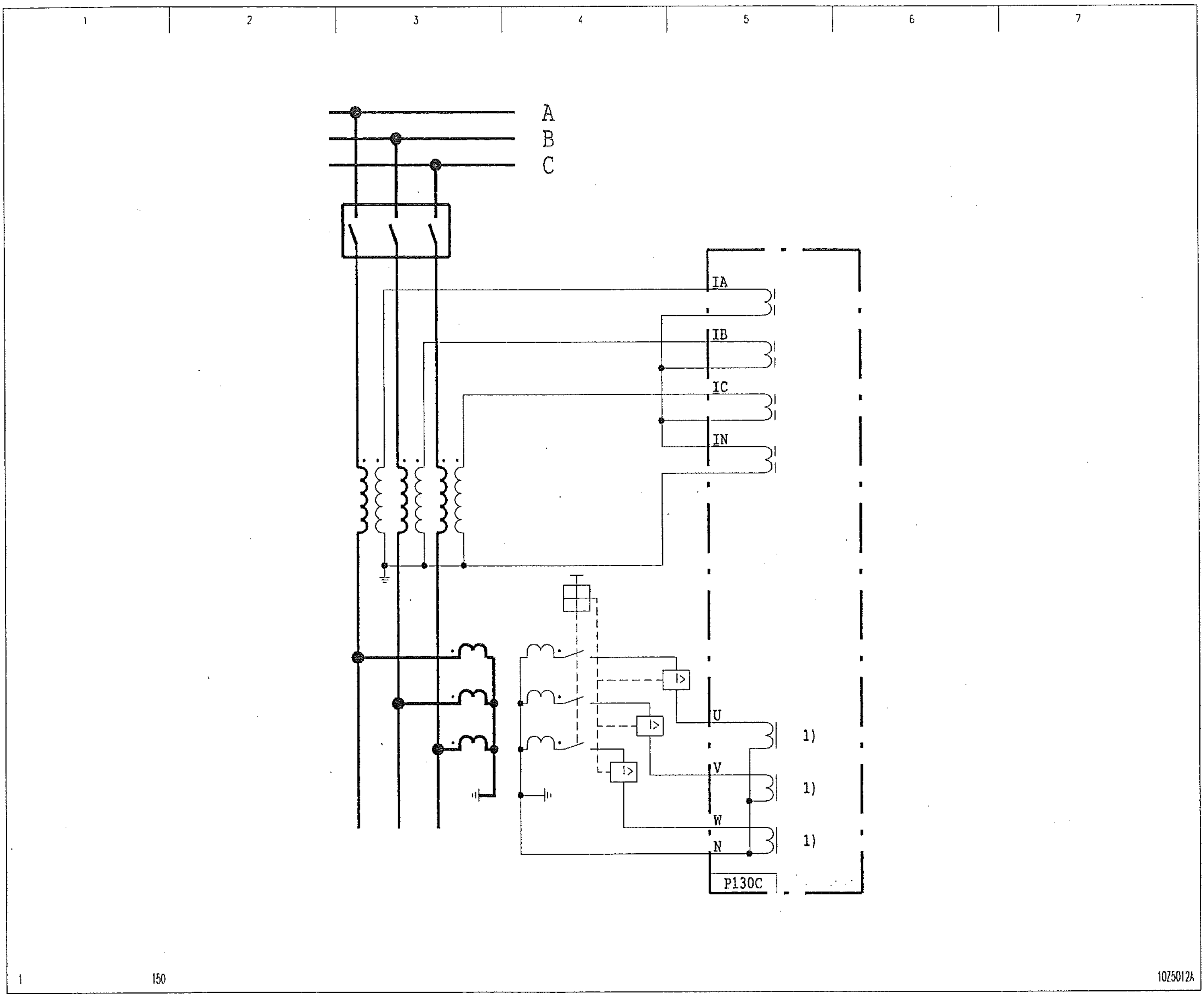
When connecting the system transformers, check to make sure that the secondary nominal currents of the system and the unit agree.

The secondary circuit of operating current transformers must not be opened. If the secondary circuit of an operating current transformer is opened, there is the danger that the resulting voltages may injure personnel or damage the insulation.

The threaded terminal block for current transformer connection is not a shorting block. Therefore always short-circuit current transformers before loosening the threaded terminals.

Connecting the measuring circuits

The system current transformers must be connected in accordance with the standard schematic diagram shown in Figure 5-7. It is essential that the grounding configuration shown in the diagram be followed. If a connection is in opposition, this can be taken into account when making settings (see Chapter 7).



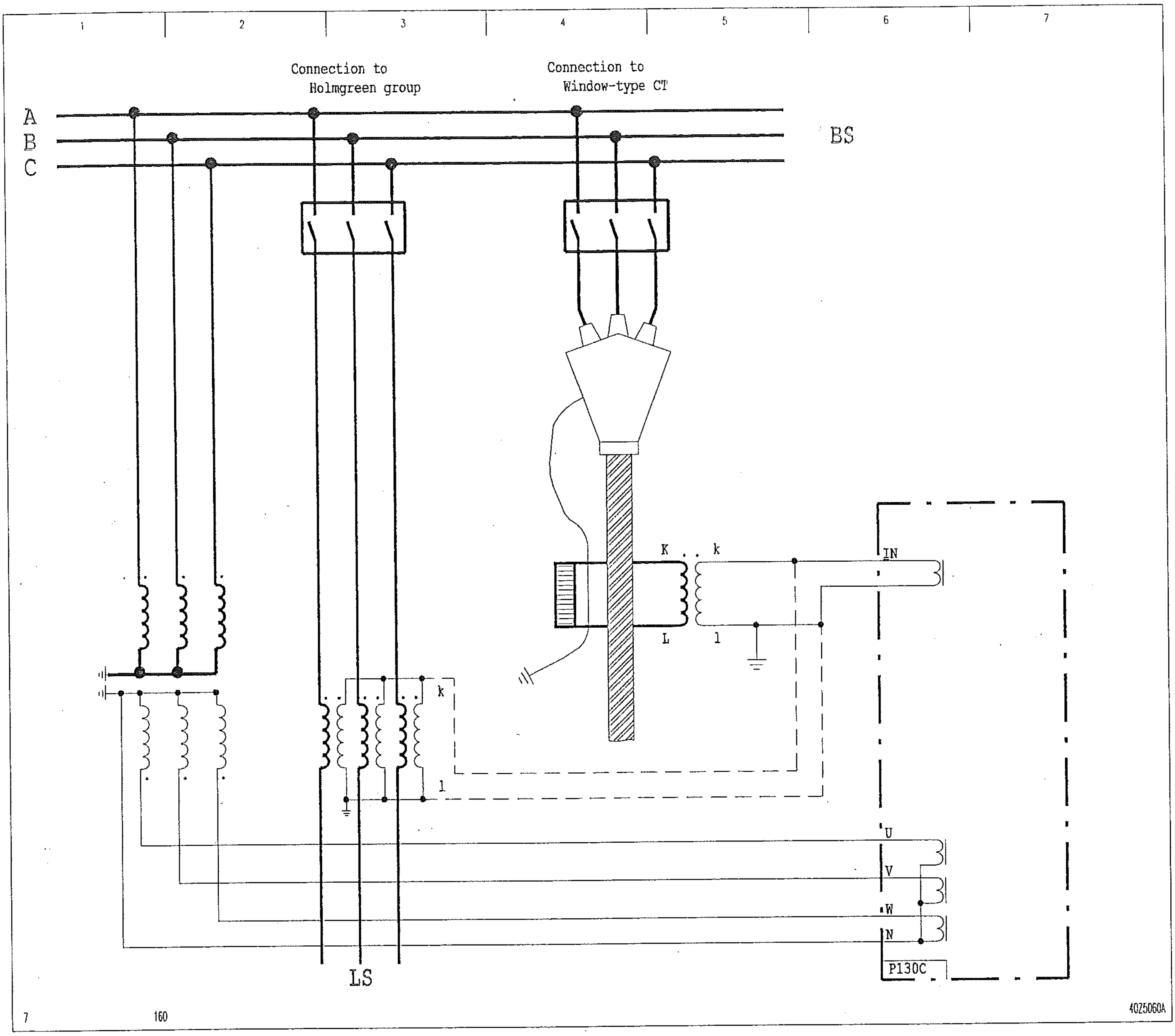
5-7 *Standard schematic diagram for the P130C.*
1) The current transformers are not fitted in the frequency protection model.

Connecting the measuring circuits for ground fault direction determination using steady-state values

If P130C operation is to include the GFDSS function (ground fault direction determination using steady-state values), then the T 4 current transformer must be connected to a window-type current transformer or a current transformer in Holmgreen configuration. If the metal sheath of the cable is led through the window-type transformer, then the overhead ground wire must be led through the core again before it is connected to ground. The cable sealing end must be attached so that it is insulated from ground. This ensures that any currents flowing through the sheath will not affect measurement.

Ground fault direction determination using steady-state values (GFDSS) requires the three phase-to-ground voltages as the measuring voltage. From these, the P130C calculates the the neutral-displacement voltage. The phase voltages are taken from the same transformers as the measured variables for distance protection.

Figure 5-8 shows the standard connection for the GFDSS function. With this connection configuration, 'forward/LS' is displayed if a ground fault occurs on the line side. A different connection direction for the current or voltage transformer is possible if the appropriate setting is made (see Chapter 7).

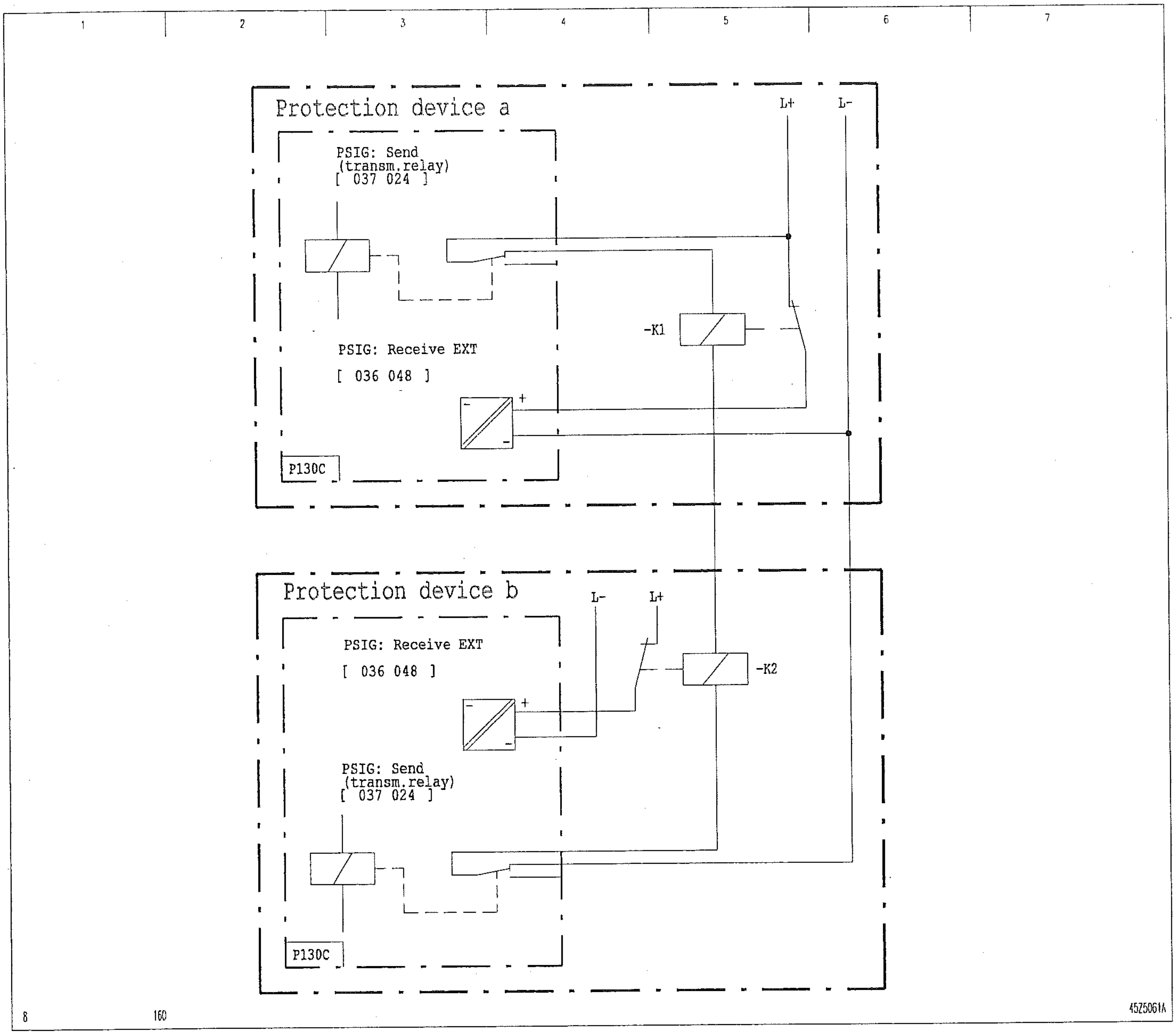


5-8 *Connecting the GFDSS function to Holmgreen-configuration transformers and window-type transformers*

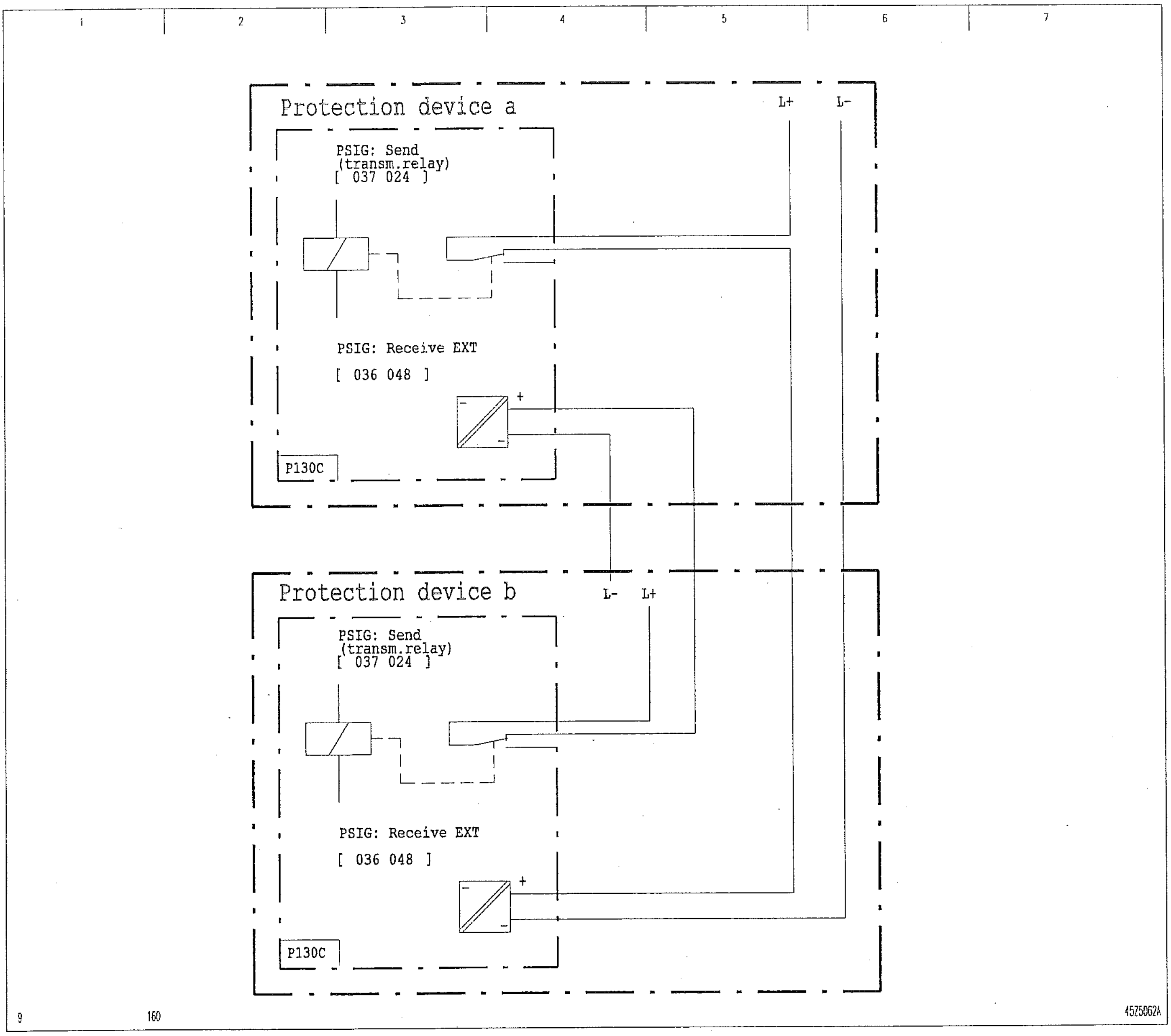
Connecting the signal inputs of protective signaling

Either a transmission device or pilot wires are required for signal transmission, depending on the operating mode selected. Transposed or twisted lines should be used for the pilot wires. Two or four lines are required. If only two lines are available, there must be an all-or-nothing relay in each station for coupling received and transmitted signals. The coils of the all-or-nothing relays must be designed for half the loop voltage. Figure 5-9 shows connection with two lines and Figure 5-10 connection with four lines.

The protective signaling transmitting relay can be set to either *Transm. relay break contact* or *Transm. relay make contact.* In the first case the break contact of the transmitting relay must be wired, and in the second case the make contact must be wired. The figures show the connection for the setting *Transm. relay break contact*.



5-9 *Connection of the protective signaling function with two lines*



5-10 *Connection of the protective signaling function with four lines*

Connecting the binary inputs and output relays

The binary inputs and output relays are freely configurable.

The terminal connection diagrams give a polarity for connection of the binary signal inputs. However, this is only a recommendation. Connection can be as desired.

5.6.2 Connecting the IRIG-B Interface

An IRIG-B-interface for time synchronization may be installed as an optional feature. It is connected by means of a BNC connector. Coaxial cable having a characteristic impedance of 50 Ω must be used as the connecting cable.

5.6.3 Connecting the Serial Interfaces

PC interface

The PC interface is provided in order to operate the unit from a personal computer (PC).

The PC interface is not designed for permanent connection. Consequently, the female connector does not have the extra insulation from circuits connected to the system that is required per VDE 0106 Part 101.

Communication interfaces

Communication interfaces are provided for permanent connection of the unit to a control system for substations or to a central substation unit. The unit is connected to communication channel 1 either by a special connector with optical fibers or an RS 485 interface with twisted copper wires, depending on the type of communication interface. Connection to channel 2 is always by way of an RS 485 interface.

The selection and assembly of a properly cut fiber-optic connecting cable requires special knowledge and expertise and is therefore not covered in this operating manual.

The fiber-optic interface may only be connected or disconnected when the supply voltage for the unit is shut off.

A communication link consisting of a communication master and several slaves can be established via the RS 485 interface. The communication master can be a control station, for example. The devices connected to the communication master, such as the P130C, are the communication slaves.

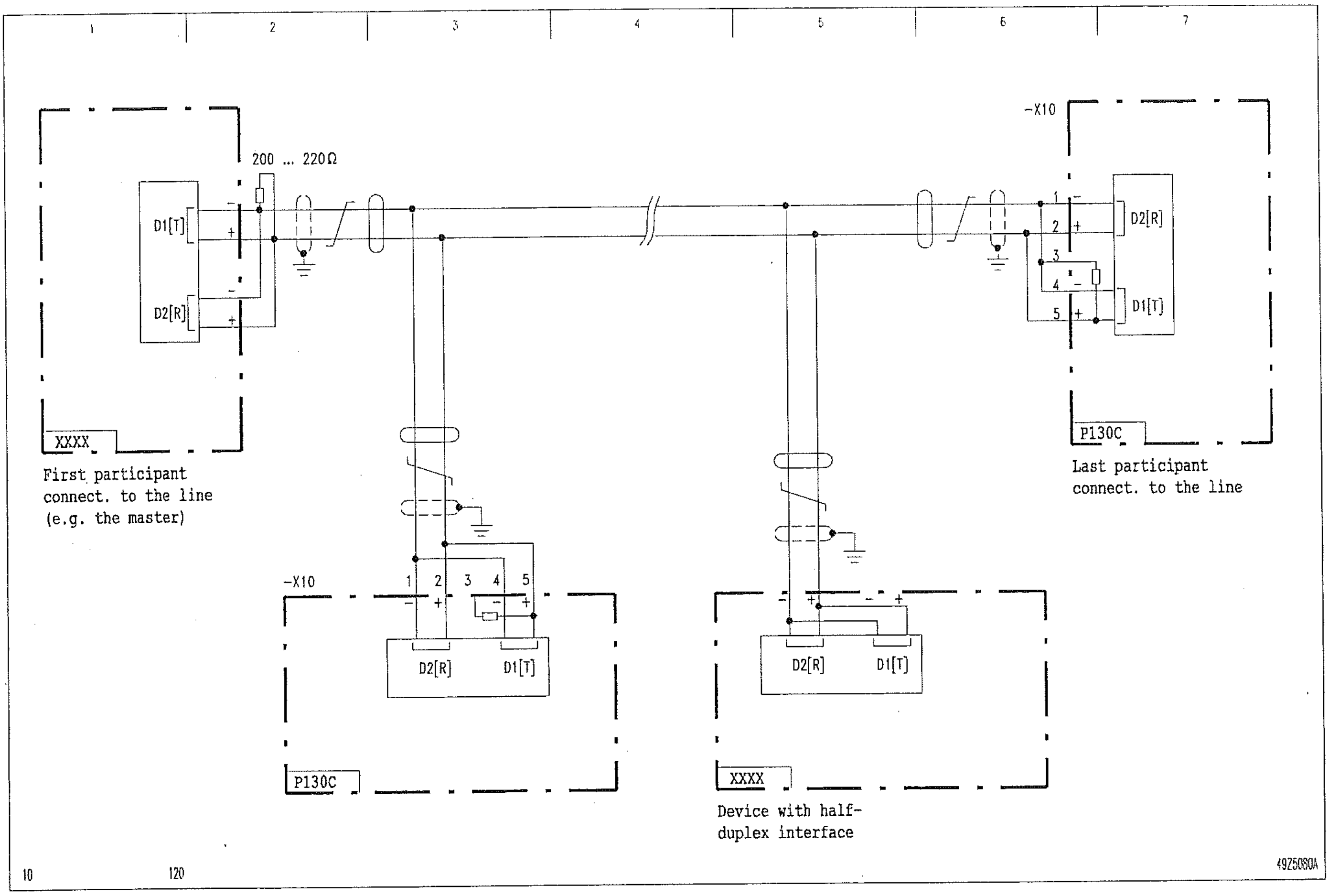
The RS 485 interface of the P130C is designed electrically to permit full-duplex operation through a 4-wire connection. However, communication through the RS 485 interface is always in the half-duplex mode of operation. The following connection instructions must always be followed:

- Always use twisted-pair shielded cables only, the kind used for telecommunications systems.
- At least one symmetrically twisted core pair will be required.
- Strip cable cores and cable shield right at the connection point and connect properly in accordance with specifications.
- Ground all shields at both ends (large-area grounding).
- Ground free (unshielded) cores at one end only.

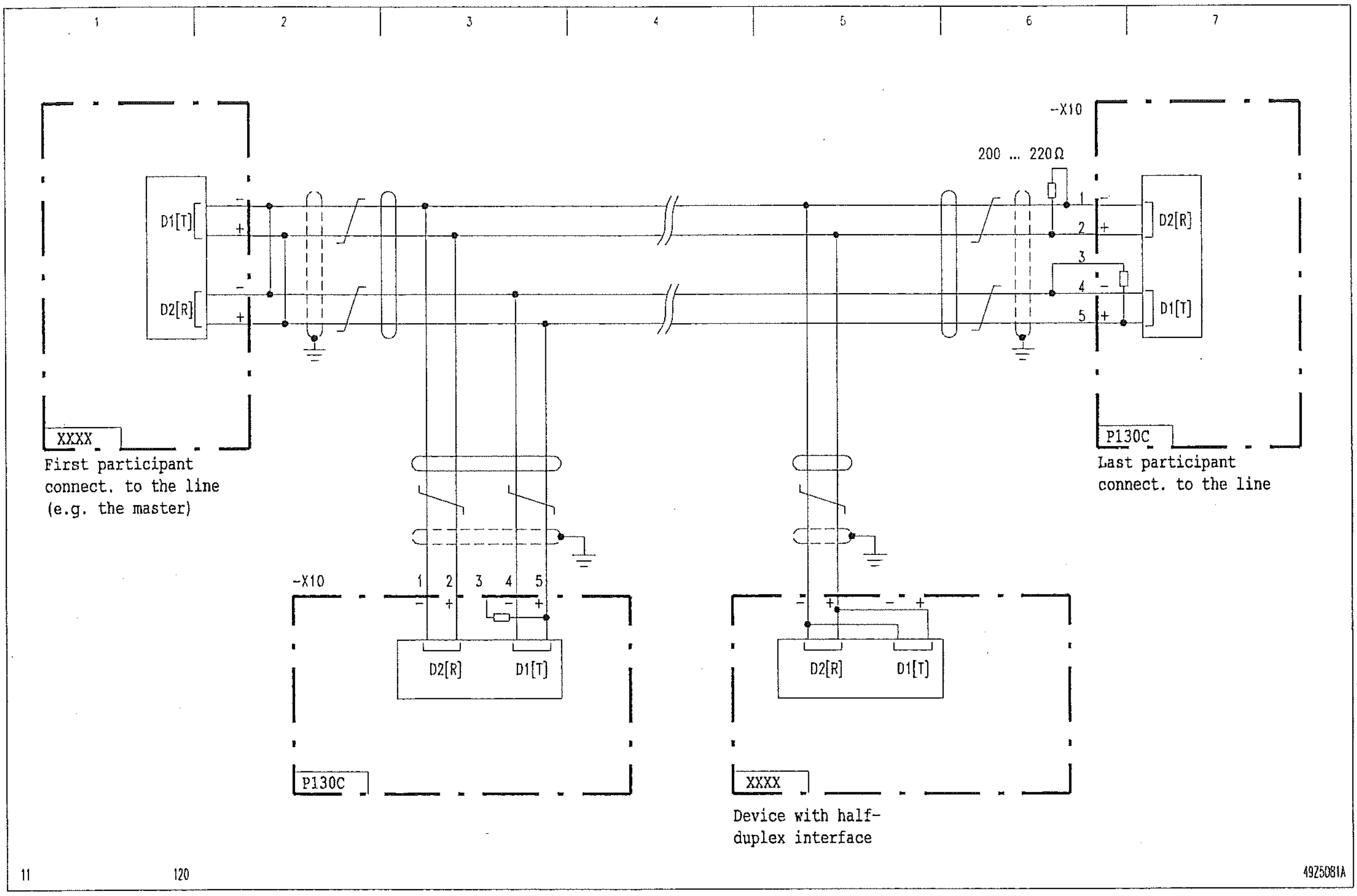
As another option, a 2-wire or 4-wire connection is also possible. For the 4-wire connection, a cable with two symmetrically twisted core pairs is required. Figure 5-11 shows the 2-wire connection and Figure 5-12 the 4-wire connection, as illustrated for channel 2 of the communication module. If channel 1 of the communication module is designed as an RS 485 interface, then the same arrangement would apply.

<u>2-wire connection</u>:
Transmitter and receiver must be bridged in all devices that have a full-duplex interface as part of their electrical system – like the P130C, for example. In the two devices that form the physical ends of the line, the pair of leads must be terminated by a 200-to-220-Ω resistor. In most ALSTOM devices, and also in the P130C, a 220-Ω resistor is integrated into the RS 485 interface and can be connected by means of a wire jumper. An external resistor is therefore not necessary.

<u>4-wire connection</u>:
Transmitter and receiver must be bridged in the device that forms one physical end of the line. The receivers of the slaves that have a full-duplex interface as part of their electrial system (like the P130C, for example) are connected to the transmitter of the communication master, and the transmitters of the slaves are connected to the receiver of the master. Devices that only have a half-duplex interface are connected to the transmitter of the communication master. In the last physical participant (master or slave) of the communication link, the transmitter and receiver must each be terminated by a 200-to-220-Ω resistor. In most ALSTOM devices, and also in the P130C, a 220-Ω resistor is integrated into the RS 485 interface and can be connected by means of a wire jumper. An external resistor is therefore not necessary. The second resistor must be connected to the device externally (see Chapter 13 for the resistor Order No.).



5-11 *2-wire connection*



5-12 *4-wire connection^*

6 Local Control Panel

Local control panel

All data required for operation of the protection device are entered from the local control panel, and the data important for system management are read out there as well. The following tasks can be handled from the local control panel:

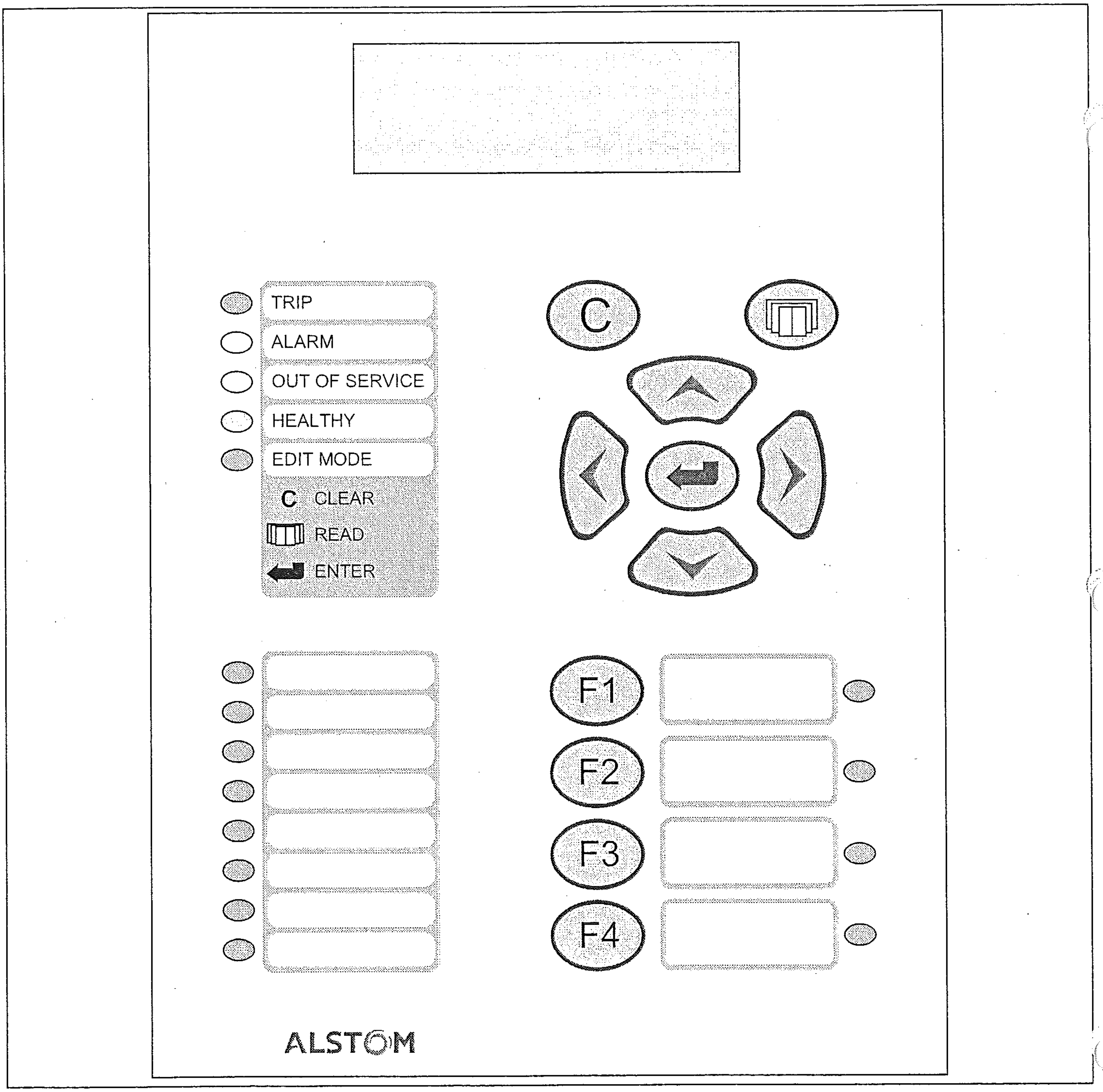
- Readout and modification of settings
- Readout of cyclically updated measured operating data and logic state signals
- Readout of operating data logs and of monitoring signal logs
- Readout of event logs after overload situations, ground faults, or short circuits in the power system
- Device resetting and triggering of additional control functions used in testing and commissioning

Control through the PC interface is also possible. This requires a suitable PC and operating program (S&R-103).

6.1 Display and Keypad

Control and display elements

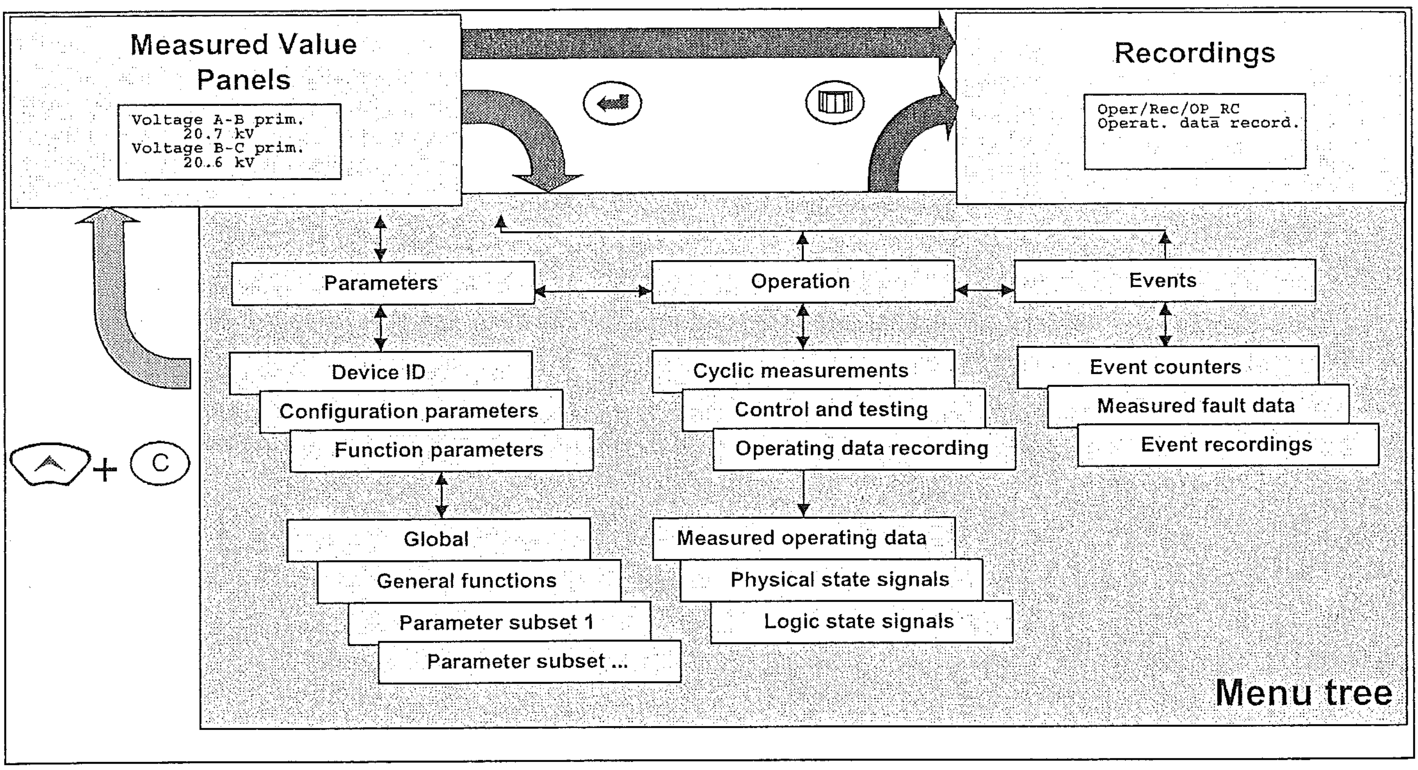
The local control panel consists of an LCD display containing 4 x 20 alphanumeric characters, eleven function keys positioned below the display, and 17 LED indicators.



6-1 View of the local control panel

Display levels

All data relevant for operation and all device settings are displayed on two levels. At the Panel level, data such as measured operating data are displayed in Panels that provide a quick overview of the current state of the bay. The menu tree level below the Panel level allows the user to select all *data points* (settings, signals, measured variables, etc.) and to change them, if appropriate. The user can access a selected event recording (event log) from either the Panel level or from any other point in the menu tree, by pressing the READ key.



6-2 *Display Panels and menu tree*

6 Local Control Panel
(continued)

Display Panels

The P430 can display 'Measured Value Panels' which are called up by the device according to system conditions.

Selected measured values are displayed on the Measured Value Panels. The system condition determines which Panel is called up (examples are the Operation Panel and the Fault Panel). Only the Measured Value Panels relevant for the design version of the given unit and its associated range of functions are actually available. The Operation Panel is always available.

Menu tree and data points

All data points (setting values, signals, measured values, etc.) are selected using a *menu tree*. As the user navigates through the menu tree, the first two lines of the LCD display always show the branch of the menu tree that is active, as selected by the user. The data points are accessed at the lowest level of a menu tree branch. They are displayed either with their plain text description or in numerically coded form, as selected by the user. The value associated with the selected data point, its meaning, and its unit of measurement are displayed in the line below.

List data points

List data points are a special category. In contrast to other data points, list data points generally have more than one value element associated with them. This category includes tripping matrices, programmable logic functions, and event logs. When a list data point is selected, the symbol '↓' is displayed in the bottom line of the LCD display, indicating that there is another level below the displayed level. The individual value elements of a list data point are found at the lower level. In the case of a list *parameter*, the individual value elements are linked by operators such as 'OR'.

Keys

- 'Up' and 'Down' Keys

  Panel Level:
  Press the 'Up' and 'Down' keys to switch between the pages of the Measured Value Panel.
  Menu Tree Level:
  Press the 'Up' and 'Down' keys to navigate up and down through the menu tree in a vertical direction. If the unit is in input mode, the 'Up' and 'Down' keys have a different function.
  Input mode:
  Parameter values can only be changed in the input mode, which is signaled by the LED indicator labeled EDIT MODE. Press the 'Up' and 'Down' keys in this mode to change the parameter value.
  ('Up' key: the next higher value is selected.
  'Down' key: the next lower value is selected.)
  With list parameters, press the 'Up' and 'Down' key to change the logic operator of the value element.

- 'Left' and 'Right' Keys

  Menu Tree Level:
  Press the 'Left' and 'Right' keys to navigate through the menu tree in a horizontal direction. If the unit is in input mode, the 'Left' and 'Right' keys have a different function.
  Input mode:
  Parameter values can only be changed in the input mode, which is signaled by the LED indicator labeled EDIT MODE. When the 'Left' and 'Right' keys are pressed, the cursor positioned below one of the digits in the change-enabled value moves one digit to the right or left.
  ('Left' key: the cursor moves to the next digit on the left.
  'Right' key: the cursor moves to the next digit on the right.)
  In the case of a list parameter, press the 'Left' and 'Right' keys to navigate through the list of items available for selection.

- ENTER Key

  Panel Level:
  Press the ENTER key at the Panel level to go to the menu tree.
  Menu Tree Level:
  Press the ENTER key to enter the input mode. Press the ENTER key a second time to accept the changes as entered and exit the input mode. The LED indicator labeled EDIT MODE signals that the input mode is active.

- CLEAR Key

  Press the CLEAR key to reset the LED indicators and clear all measured event data. The records in the recording memories are not affected by this action.
  Input mode:
  Press the CLEAR key to reject the changes entered and exit the input mode.

- READ Key

  Press the READ key to access the set of user-selected functions (see "Configurable Function Keys" in Chapter 3) from either the Panel level or from any other point in the menu tree. Repeated pressing of the READ key will then sequentially trigger the selected functions (such as event recordings or setting parameters) if several functions have been selected.

- **Function Keys** (F1) to (Fx)
  A single function or a menu jump list can be assigned to each function key (see "Configurable Function Keys" in Chapter 3). Once a menu jump list has been assigned to a function key, then repeated pressing of the function key will sequentially trigger the selected functions.

The following tables, which show the individual control steps, specify the displays that can be changed by pressing specific keys. A small black square to the right of the ENTER key indicates that the LED indicator labeled EDIT MODE is on. The examples shown here do not necessarily apply to the device type described in this manual; they merely serve to illustrate the control principles involved.

6.2 Illumination of the Display

If none of the control keys is pressed, the display illumination will switch off once the set return time has elapsed ('return time illumination' setting in the menu tree at 'Par/Conf/LOC'). The display illumination is turned on again by pressing one of the control keys. In this case, the control action that is normally triggered by the key will not be executed. This response is also exhibited by the function keys. Reactivation of display illumination is also possible by way of a binary input.

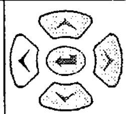
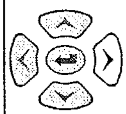
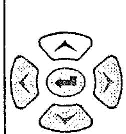
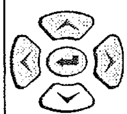
If continuous illumination is desired, the user can set the 'return time illumination' function to *'blocked'*.

6.3 Configurable Function Keys F1 to Fx

Function key F1 is not enabled unless the associated password `F_KEY: Password funct. key1` has been entered first. Once the password has been entered, the function key remains active for no longer than the set time `F_KEY: Return time fct.keys`. Thereafter, the function key is disabled until the password is entered again. The same rules apply to function keys F2 to Fx.

In the following example, the password for the function keys is the factory-set password. If the password has been changed by the user (see the section entitled 'Changing the Password'), the following description will apply analogously.

6 Local Control Panel
(continued)

Control Step / Description	Control Action	Display
0 Display example.		Voltage C-A prim. 20.8 kV Current A prim. 415 A
1 Press function key F1. Eight asterisks (*) appear in the fourth line as a prompt for entering the password.	F1	 ********
2a Press the following keys in sequence: 'Left'		*
'Right'		*
'Up'		*
'Down' The display will change as shown in the column on the right.		*
Now press the ENTER key. If the correct password has been entered, the the previous display will re-appear. Function keys F1 to Fx are enabled for the set return time. If an invalid password has been entered, the display shown in Step 1 appears.		Voltage C-A prim. 20.8 kV Current A prim. 415 A
2b Until the enter key is pressed, the control action can be aborted at any time by pressing the CLEAR key.	C	Voltage C-A prim. 20.8 kV Current A prim. 415 A
3 Press F1 again. The function assigned to this function key will now be executed.	F1	Voltage C-A prim. 20.8 kV Current A prim. 415 A
4 If you press any further function keys while the return time is running, the assigned functions will be executed without a further password prompt.	Fx	Voltage C-A prim. 20.8 kV Current A prim. 415 A

6.4 Changing Between Display Levels

After start-up of the device, the menu tree level is displayed.

	Control Step / Description	Control Action	Display

Going from the menu tree level to the Panel level	**0** From the menu tree level, the user can go to the Panel level from any position within the menu tree.		`Par/Func/Glob/MAIN`
			`Device on-line`
			`No (=off)`

	1 First press the 'Up' key and hold it down while pressing the CLEAR key.
	
	Note:
	It is important to press the 'Up' key first and release it last to avoid unintentional resetting of stored data.
		+ C	`Voltage C-A prim.`
			`20.8 kV`
			`Current A prim.`
			`415 A`

Going from the Panel level to the menu tree level	**0** Example of a Measured Value Panel.		`Voltage C-A prim.`
			`20.8 kV`
			`Current A prim.`
			`415 A`

	1 Press the ENTER key to go from the Panel level to the menu tree level.		`XX YYY`

After the set return time has elapsed (setting in menu tree: 'Par/Conf/LOC'), the display will automatically switch to the Panel level if a Measured Value Panel has been configured.

6.5 Control at the Panel Level

The measured values to be displayed on the Measured Value Panels can first be selected at 'Par/Conf/LOC' in the menu tree. The user can select different sets of measured values for the Operation Panel, the Overload Panel, the Ground Fault Panel, and the Fault Panel. Only the Measured Value Panels relevant for the design version of the given unit and its associated range of functions are actually available. The selected set of values for the Operation Panel is always available. Please see the section entitled 'Setting a List Parameter' for instructions regarding selection. If the user has selected `MAIN: Without function` for a Panel, then that Panel will be inactive.

The Measured Value Panels are called up in accordance with system conditions. If, for example, the unit detects an overload or a ground fault, then the corresponding Measured Value Panel will be displayed as long as the overload or ground fault situation exists. If the unit detects a fault, then the Fault Panel is displayed and remains active until the measured fault values are reset – by pressing the CLEAR key (C), for example.

Control Step / Description	Control Action	Display

0 Up to six selected measured values can be displayed simultaneously on the Panel.		`Voltage A-B prim.`
		`20.7 kV`
		`Voltage B-C prim.`
		`20.6 kV`

1 If more than two measured values have been selected, they can be viewed one page at a time by pressing the 'Up'/'Down' keys. The next page of the Measured Value Panel will also be displayed after the set Panel hold time has elapsed (setting in menu tree at 'Par/Conf/LOC').	▲ or ▼	`Voltage C-A prim.`
		`20.8 kV`
		`Current A prim.`
		`415 A`

6.6 Control at the Menu Tree Level

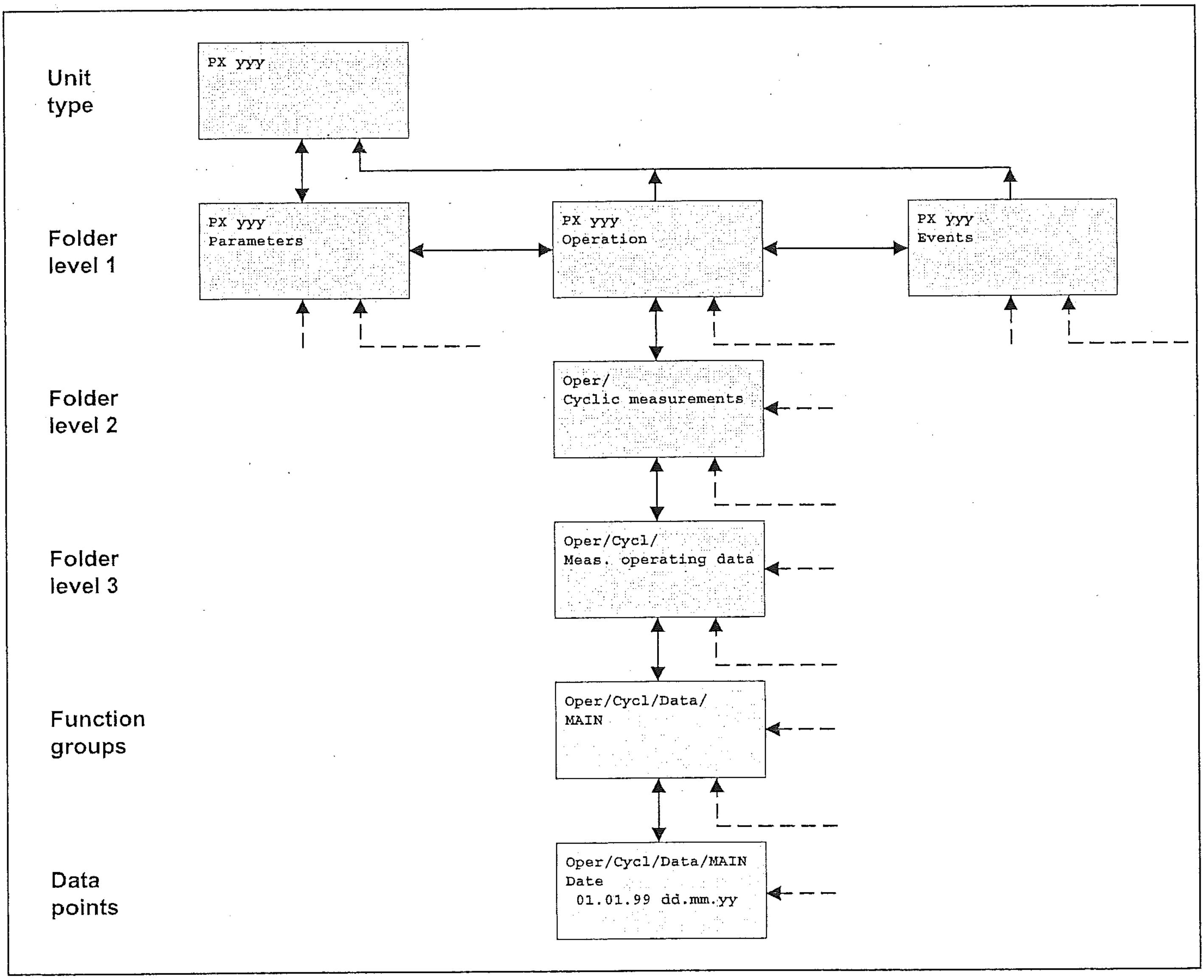
6.6.1 Navigation in the Menu Tree

Folders and function groups

All data points are grouped according to their function group association and are also organized in different folders based on practical control requirements.

At the root of the menu tree is the unit type; the tree branches into the three main folders 'Parameters', 'Operation' and 'Events', which form the first folder level. Up to two further folder levels follow so that the entire folder structure consists of three main branches and a maximum of three folder levels.

At the end of each branch of folders are the various function groups in which the individual data points are combined.



6-3 Basic menu tree structure

6.6.2 Switching Between Address Mode and Plain Text Mode

The display on the local control panel can be switched between address mode and plain text mode. In the address mode the display shows setting parameters, signals, and measured values in numerically coded form, that is, as addresses. In plain text mode the setting parameters, signals, and measured values are displayed in the form of plain text descriptions. In either case, control is guided by the menu tree. The active branch of the menu tree is displayed in plain text in both modes. In the following examples, the display is shown in plain text mode only.

Control Step / Description	Control Action	Display
0 In this example, the user switches from plain text mode to address mode.		Par/Func/Glob/MAIN Device on-line No (=off)
1 To switch from address mode to plain text mode or vice versa, press the CLEAR key (C) and either the 'Left' key or the 'Right' key simultaneously. This can be done at any point in the menu tree.	(C) + (<) or (C) + (>)	Par/Func/Glob/MAIN 003.030 0

6.6.3 Change-Enabling Function

Although it is possible to select any data point in the menu tree and read the associated value by pressing the keys, it is not possible to switch directly to the input mode. This safeguard prevents unintended changes in the settings.

There are two ways to enter the input mode.

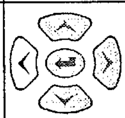
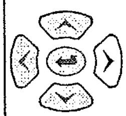
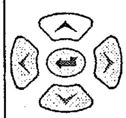
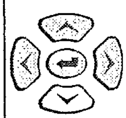
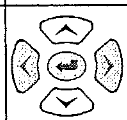
Global change-enabling function

- ☐ To activate the global change-enabling function, set the 'Param. change enabl.' parameter to 'Yes' (menu tree: 'Oper/CtrlTest/LOC').
  The change can only be made after the password has been entered. Thereafter, all further changes – with the exception of specially protected control actions (see the section entitled 'Password-Protected Control Actions') – are enabled without entering the password.

Selective change-enabling function

- ☐ Password input prior to any parameter change.

The password consists of a pre-defined sequential key combination entered within a specific time interval. The following example is based on the factory-set password. If the password has been changed by the user (see the section entitled 'Changing the Password'), the following description will apply analogously.

Control Step / Description	Control Action	Display
0 In the menu tree 'Oper/CtrlTest/LOC', select the 'Param. change enabl.' parameter.		Oper/CtrlTest/LOC Param. change enabl. No
1 Press the ENTER key. Eight asterisks (*) appear in the fourth line of the display.		Oper/CtrlTest/LOC Param. change enabl. No ********
2 Press the following keys in sequence: 'Left'		Oper/CtrlTest/LOC Param. change enabl. No *
'Right'		Oper/CtrlTest/LOC Param. change enabl. No *
'Up'		Oper/CtrlTest/LOC Param. change enabl. No *
'Down' The display will change as shown in the column on the right.		Oper/CtrlTest/LOC Param. change enabl. No *
Now press the ENTER key. The LED indicator labeled EDIT MODE will light up. This indicates that the setting can now be changed by pressing the 'Up' or 'Down' keys. If an invalid password has been entered, the display shown in Step 1 appears.		Oper/CtrlTest/LOC Param. change enabl. No
3 Change the setting to '*Yes*'.		Oper/CtrlTest/LOC Param. change enabl. Yes
4 Press the ENTER key again. The LED indicator will go out. The unit is enabled for further parameter changes.		Oper/CtrlTest/LOC Param. change enabl. Yes

The same procedure applies to any parameter change unless the global change-enabling function has been activated. This method is recommended for a single parameter change only. If several settings are to be changed, then the global change-enabling function is preferable. In the following examples, the global change-enabling function has been activated.

Automatic return

The automatic return function prevents the change-enabling function from remaining activated after a change of settings has been completed. Once the set return time (menu tree 'Par/Conf/LOC') has elapsed, the change-enabling function is automatically deactivated, and the display switches to a Measured Value Panel corresponding to the current system condition. The return time is restarted when any of the control keys is pressed.

Forced return

The return described above can be forced from the local control panel by first pressing the 'Up' key and then holding it down while pressing the CLEAR key.

Note: It is important to press the 'Up' key first and release it last in order to avoid unintentional deletion of stored data.

Even when the change-enabling function is activated, not all parameters can be changed. For some settings it is also necessary to disable the protective function (menu tree: Par/Func/Glob/MAIN, 'Protection enabled'). Such settings include the configuration parameters, by means of which the device interfaces can be adapted to the system. The following entries in the "Change" column of the address list (see appendix) indicate whether values can be changed or not:

- **"on"**: The value can be changed even when the protective function is enabled.
- **"off"**: The value can only be changed when the protective function is disabled.
- **"-"**: The value can be read out but cannot be changed.

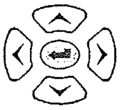
The device is factory-set so that the protective function is disabled.

6.6.4 Changing Parameters

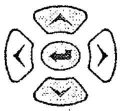
If all the conditions for a value change are satisfied (see above), the desired setting can be entered.

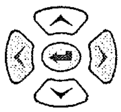
Control Step / Description	Control Action	Display

0 Example of a display.
In this example, the change-enabling function is activated and the protective function is disabled, if necessary.
		`Oper/CtrlTest/LOC`
		`Param. change enabl.`
		`Yes`

1 Select the desired parameter by pressing the keys.		`Par/Conf/LOC`
		`Autom. return time`
		`50000 s`

2 Press the ENTER key. The LED indicator labeled EDIT MODE will light up. The last digit of the value is highlighted by a cursor (underlined).		`Par/Conf/LOC`
		`Autom. return time`
		`50000 s`

3 Press the 'Left' or 'Right' keys to move the cursor to the left or right.		`Par/Conf/LOC`
		`Autom. return time`
		`50000 s`

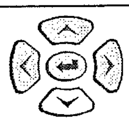
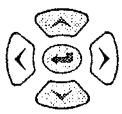
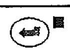
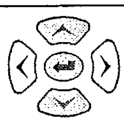
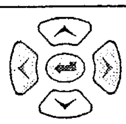
4 Change the value highlighted by the cursor by pressing the 'Up' and 'Down' keys. In the meantime the device will continue to operate with the old value.		`Par/Conf/LOC`
		`Autom. return time`
		`50010 s`

5 Press the ENTER key. The LED indicator labeled EDIT MODE will go out and the device will now operate with the new value. Press the keys to select another setting parameter for a value change.		`Par/Conf/LOC`
		`Autom. return time`
		`50010 s`

6 If you wish to reject the new setting while you are still entering it (LED indicator labeled EDIT MODE is on), press the CLEAR key. The LED indicator will go out and the device will continue to operate with the old value. A further parameter can be selected for a value change by pressing the keys.		`Par/Conf/LOC`
		`Autom. return time`
		`50000 s`

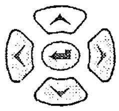
6.6.5 Setting a List Parameter

Using list parameters, the user is able to select several elements from a list in order to perform tasks such as defining a trip command or defining the measured values that will be displayed on Measured Value Panels. The maximum possible number 'm' that can be selected out of the total number 'n' of the set is given in the address list in the 'Remarks' column. As a rule, the selected elements are linked by an 'OR' operator. Other operators (NOT, OR, AND, NOT OR and NOT AND) are available in the LOGIC function group for linking the selected list items. In this way binary signals and binary input signals can be processed in a Boolean equation tailored to meet user requirements. For the DNP 3.0 communication protocol, the user defines the class of a parameter instead of assigning operators. The definition of a trip command shall be used here as an example to illustrate the setting of a list parameter.

Control Step / Description	Control Action	Display
0 Select a list parameter (in this example, the parameter 'Fct.assign.trip cmd.' at 'Par/Func/Glob/ MAIN' in the menu tree). The down arrow (↓) indicates that a list parameter has been selected.		Par/Func/Glob/MAIN Fct.assign.trip cmd. ↓
1 Press the 'Down' key. The first function and the first selected signal will appear in the third and fourth lines, respectively. The symbol '#01' in the display indicates the first item of the selection. If 'MAIN: Without function' appears for the first item, then this means that no function assignment has been made yet.		Par/Func/Glob/MAIN Fct.assign.trip cmd. #01 DIST Trip zone 1
2 Scroll through the list of assigned functions by pressing the 'Right' and 'Left' keys. Once the end of the list is reached, the display shown on the right will appear.		Par/Func/Glob/MAIN Fct.assign.trip cmd. OR #02 DIST Trip zone 2 Par/Func/Glob/MAIN Fct.assign.trip cmd. #05 MAIN ?????
3 Press the ENTER key at any position in the list. The LED indicator labeled EDIT MODE will light up.		Par/Func/Glob/MAIN Fct.assign.trip cmd. #02 DIST Trip zone 2
4 Scroll through the assignable functions by pressing the 'Right' and 'Left' keys in the input mode.		Par/Func/Glob/MAIN Fct.assign.trip cmd. #02 DIST Trip zone 4
5 Select the operator or the class using the 'Up' and 'Down' keys. In this particular case, only the 'OR' operator can be selected. There is no limitation on the selection of classes.		Par/Func/Glob/MAIN Fct.assign.trip cmd. OR #02 DIST Trip zone 4

Control Step / Description	Control Action	Display

6 Press the ENTER key. The LED indicator will go out. The assignment has been made. The unit will now operate with the new settings.
 	
If no operator has been selected, the 'OR' operator is <u>always</u> assigned automatically when the ENTER key is pressed. There is no automatic assignment of classes.
	(C)	`Par/Func/Glob/MAIN`
		`Fct.assign.trip cmd.`
		`OR          #02 DIST`
		`Trip zone 4`

7 Press the 'Up' key to exit the list at any point in the list.		`Par/Func/Glob/MAIN`
		`Fct.assign.trip cmd.`
		↓

8 If you wish to reject the new setting while you are still entering it (LED indicator labeled EDIT MODE is on), press the CLEAR key. The LED indicator will go out.	(C)	`Par/Func/Glob/MAIN`
		`Fct.assign.trip cmd.`
		`OR          #02 DIST`
		`Trip zone 2`

Deleting a list parameter

If 'MAIN: Without function' is assigned to a given item, then all the following items are deleted. If this occurs for item #01, everything is deleted.

6.6.6 Memory Readout

After a memory is entered, the memory can be read out at the entry point. It is not necessary to activate the change-enabling function or even to disable the protective functions. Inadvertent clearing of a memory at the entry point is not possible.

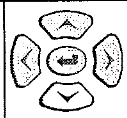
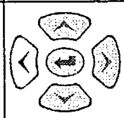
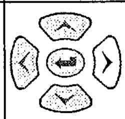
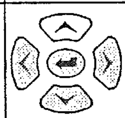
The following memories are available:

- In the menu tree 'Oper/Rec/OP_RC': Operating data memory
- In the menu tree 'Oper/Rec/MT_RC': Monitoring signal memory
- Event memories
  - In the menu tree 'Events/Rec/FT_RC': Fault memories 1 to 8
  - In the menu tree 'Events/Rec/OL_RC': Overload memories 1 to 8
  - In the menu tree 'Events/Rec/GF_RC': Ground fault memories 1 to 8

Not all of these event memories are present in each unit. A given unit may contain only some of them or even none at all, depending on the device type.

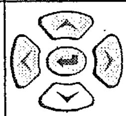
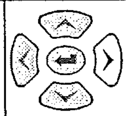
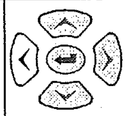
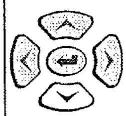
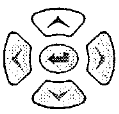
Readout of the operating data memory

The operating data memory contains stored signals of actions that occur during operation, such as the enabling or disabling of a device function. A maximum of 100 entries is possible, after which the oldest entry is overwritten.

Control Step / Description	Control Action	Display
0 Select the entry point for the operating data memory.		Oper/Rec/OP_RC Operat. data record. ↓
1 Press the 'Down' key to enter the operating data memory. The latest entry is displayed.		Oper/Rec/OP_RC 01.01.97 11:33 ARC Enabled USER No
2 Press the 'Left' key repeatedly to display the entries one after the other in chronological order. Once the end of the operating data memory has been reached, pressing the 'Left' key again will have no effect.		Oper/Rec/OP_RC 01.01.97 10:01 PSIG Enabled USER Yes
3 Press the 'Right' key to display the previous entry.		Oper/Rec/OP_RC 01.01.97 11:33 ARC Enabled USER No
4 Press the 'Up' key at any point within the operating data memory to return to the entry point.		Oper/Rec/OP_RC Operat. data record. ↓

Readout of the monitoring signal memory

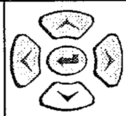
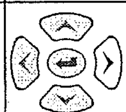
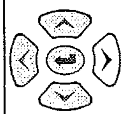
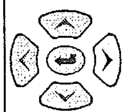
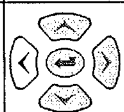
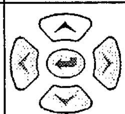
If the unit detects an internal fault in the course of internal self-monitoring routines or if it detects power system conditions that prevent flawless functioning of the unit, then an entry is made in the monitoring signal memory. A maximum of 30 entries is possible. After that an 'overflow' signal is issued.

Control Step / Description	Control Action	Display
0 Select the entry point for the monitoring signal memory.		Oper/Rec/MT_RC Mon. signal record. ↓
1 Press the 'Down' key to enter the monitoring signal memory. The oldest entry is displayed.		Mon. signal record. 01.01.97 13:33 SFMON Checksum error param
2 Press the 'Right' key repeatedly to display the entries one after the other in chronological order. If more than 30 monitoring signals have been entered since the last reset, the 'overflow' signal is displayed as the last entry.		Mon. signal record. 01.01.97 10:01 SFMON Exception oper. syst.
3 Press the 'Left' key to display the previous entry.		Mon. signal record. 01.01.97 13:33 SFMON Checksum error param
4 If the 'Down' key is held down while a monitoring signal is being displayed, the following additional information will be displayed: First: Time when the signal first occurred Active: The fault is still being detected (Yes) or is no longer detected (No) by the self-monitoring function. Reset: The fault was no longer detected by the self-monitoring function and has been reset (Yes). Number: The signal occurred x times.		Mon. signal record. 01.01.97 13:33 SFMON Checksum error param First: 13:33:59.744 Active: Yes Reset: No Number: 5
5 Press the 'Up' key at any point within the monitoring signal memory to return to the entry point.		Oper/Rec/MT_RC Mon. signal record. ↓

Readout of the event memories

There are eight event memories for each type of event. The latest event is stored in event memory 1, the previous one in event memory 2, and so forth.

Readout of event memories is illustrated using the fault memory as an example.

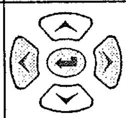
Control Step / Description	Control Action	Display
0 Select the entry point for the first fault memory, for example. If the memory contains entries, the third line of the display will show the date and time the fault began. If the third line is blank, then there are no entries in the fault memory.		Events/Rec/FT_RC Fault recording 1 01.01.99 10:00:33 ↓
1 Press the 'Down' key to enter the fault memory. First, the fault number is shown. In this example it is the 22nd fault since the last reset.		Fault recording 1 FT_RC Event 22
2 Press the 'Right' key repeatedly to see first the measured fault data and then the binary signals in chronological order. The time shown in the second line is the time, measured from the onset of the fault, at which the value was measured or the binary signal started or ended. Once the end of the fault has been reached (after the 'Right' key has been pressed repeatedly), pressing the 'Right' key again will have no effect.	  	Fault recording 1 200 ms FT_DA Running time 0.17 s Fault recording 1 0 ms FT_RC Record. in progress Start Fault recording 1 241 ms FT_RC Record. in progress End
3 Press the 'Left' key to see the previous measured value or the previous signal.		Fault recording 1 0 ms FT_RC Record. in progress Start
4 Press the 'Up' key at any point within the fault memory to return to the entry point.		Events/Rec/FT_RC Fault recording 1 01.01.99 10:00:33 ↓

6.6.7 Resetting

All information memories – including the event memories and the monitoring signal memory – as well as the LED indicators can be reset manually. In addition, the LED indicators are automatically cleared and initialized at the onset of a new fault – provided that the appropriate operating mode has been selected – so that they always indicate the latest fault.

The LED indicators can also be reset manually by pressing the CLEAR key, which is always possible in the standard control mode. This action also triggers an LED indicator test and an LCD display test. The event memories are not affected by this action, so that inadvertent deletion of the records associated with the reset signal pattern is reliably prevented.

Because of the ring structure of the event memories, the data for eight consecutive events are updated automatically so that manual resetting should not be necessary, in principle. If the event memories need to be cleared completely, however, as would be the case after functional testing, this can be done after selecting the appropriate parameter. The resetting procedure will now be illustrated using the fault memory as an example. In this example the global change-enabling function has already been activated.

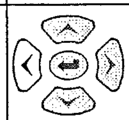
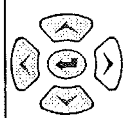
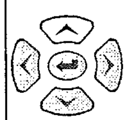
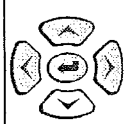
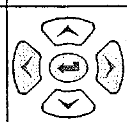
Control Step / Description	Control Action	Display
0 Select the reset parameter. Line 3 of the display shows the number of faults since the last reset, 10 in this example.		Oper/CtrlTest/FT_RC Reset recording 10
1 Press the ENTER key. The LED indicator labeled EDIT MODE will light up.		Oper/CtrlTest/FT_RC Reset recording 10 Don't execute
2 Press the 'Up' or 'Down' keys to change the setting to *'Execute'*.		Oper/CtrlTest/FT_RC Reset recording 10 Execute
3 Press the ENTER key. The LED indicator labeled EDIT MODE will go out. The value in line 3 is reset to '0'.		Oper/CtrlTest/FT_RC Reset recording 0

Control Step / Description	Control Action	Display
4 To cancel the intended clearing of the fault recordings after leaving the standard control mode (the LED indicator labeled EDIT MODE is on), press the CLEAR key. The LED indicator will go out, and the fault recordings remain stored in the device unchanged. Any parameter can be selected again for a value change by pressing the keys.	(C)	Oper/CtrlTest/FT_RC Reset recording 10

6.6.8 Password-Protected Control Actions

Certain actions from the local control panel (such as a manual trip command for testing purposes) can only be carried out by entering a password. This setup is designed to prevent accidental output and applies even when the global change-enabling function has been activated. (See also Chapter 6.3 "Configurable Function Keys F1 to Fx.)

The password consists of a pre-defined sequential key combination entered within a specific time interval. The following example illustrates the password-protected output of a manual trip command using the factory-set password. If the password has been changed by the user (see the section entitled 'Changing the Password'), the following description will apply analogously.

Control Step / Description	Control Action	Display
0 In the menu tree 'Oper/CtrlTest/MAIN', select the parameter 'Man. trip cmd. USER'.		Oper/CtrlTest/MAIN Man. trip cmd. USER Don't execute
1 Press the ENTER key. Eight asterisks (*) appear in the fourth line of the display.		Oper/CtrlTest/MAIN Man. trip cmd. USER Don't execute ********
2 Press the following keys in sequence: 'Left'		Oper/CtrlTest/MAIN Man. trip cmd. USER Don't execute *
'Right'		Oper/CtrlTest/MAIN Man. trip cmd. USER Don't execute *
'Up'		Oper/CtrlTest/MAIN Man. trip cmd. USER Don't execute *
'Down' The display will change as shown in the column on the right.		Oper/CtrlTest/MAIN Man. trip cmd USER Don't execute *
Now press the ENTER key. The LED indicator labeled EDIT MODE will light up. This indicates that the setting can now be changed by pressing the 'Up' or 'Down' keys.		Oper/CtrlTest/MAIN Man. trip cmd. USER Don't execute
3 Change the setting to *'Execute'*.		Oper/CtrlTest/MAIN Man. trip cmd. USER Execute

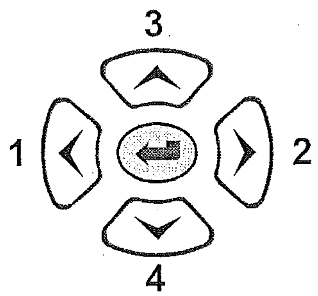
Control Step / Description	Control Action	Display

4 Press the ENTER key again. The LED indicator labeled EDIT MODE will go out. The unit will execute the command.	↵	`Oper/CtrlTest/MAIN`
		`Man. trip cmd. USER`
		`Don't execute`

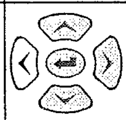
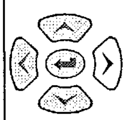
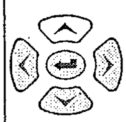
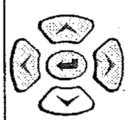
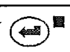
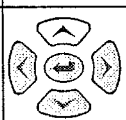
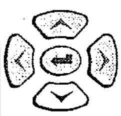
5 As long as the LED indicator labeled EDIT MODE is on, the control action can be terminated by pressing the CLEAR key. The LED indicator labeled EDIT MODE will go out.	(C)	`Oper/CtrlTest/MAIN`
		`Man. trip cmd. USER`
		`Don't execute`

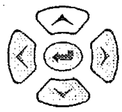
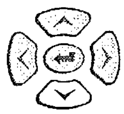
6.6.9 Changing the Password

The password consists of a combination of keys that must be entered sequentially within a specific time interval. The 'Left', 'Right', 'Up' and 'Down' keys may be used to define the password and represent the numbers 1, 2, 3 and 4, respectively:



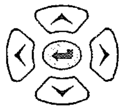
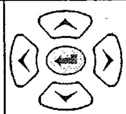
The password can be changed by the user at any time. The procedure for this change is described below. The starting point is the factory-set password.

Control Step / Description	Control Action	Display
0 In the menu tree 'Par/Conf/LOC', select the 'Password' parameter.		Par/Conf/LOC Password ********
1 Press the ENTER key. Eight asterisks appear in the fourth line of the display.		Par/Conf/LOC Password ******** ********
2 Press the 'Left', 'Right', 'Up' and 'Down' keys to enter the valid password. The display will change as shown in the column on the right.		Par/Conf/LOC Password ******** *
		Par/Conf/LOC Password ******** *
		Par/Conf/LOC Password ******** *
		Par/Conf/LOC Password ******** *
3 Now press the ENTER key. The LED indicator labeled EDIT MODE will light up. The third line shows an underscore character (_) as the prompt for entering a new password.		Par/Conf/LOC Password _
4 Enter the new password, which in this example is done by pressing the 'Up' key followed by the 'Down' key.		Par/Conf/LOC Password *
		Par/Conf/LOC Password **
5 Press the ENTER key again. Asterisks appear in the third line, and a cursor (underscore) in the fourth line prompts the user to enter the new password again.		Par/Conf/LOC Password ** _

Control Step / Description	Control Action	Display
6 Re-enter the password.	 	Par/Conf/LOC Password ** * Par/Conf/LOC Password ** **
7a Press the ENTER key again. If the password has been re-entered correctly, the LED indicator labeled EDIT MODE goes out and the display appears as shown on the right. The new password is now valid. **7b** If the password has been re-entered incorrectly, the LED indicator labeled EDIT MODE remains on and the display shown on the right appears. The password needs to be re-entered. It is also possible to cancel the change in password by pressing the CLEAR key (see Step 8).	 	Par/Conf/LOC Password ******** Par/Conf/LOC Password ** _
8 The change in password can be canceled at any time before Step 7 by pressing the CLEAR key. If this is done, the original password continues to be valid.		Par/Conf/LOC Password ********

Operation from the local control panel without password protection is also possible. To select this option, immediately press the ENTER key a second time in steps 4 and 6 without entering anything else. This will configure the local control panel without password protection, and no control actions involving changes will be possible until the global change-enabling function has been activated (see the section entitled 'Change-Enabling Function').

If the configured password has been forgotten, it can be called up on the LCD display as described below. The procedure involves turning the device off and then on again.

Control Step / Description	Control Action	Display
0 Turn off the device.		
1 Turn the device on again. At the very beginning of device startup, press the four directional keys ('Left', 'Right', 'Up' and 'Down') at the same time and hold them down.		TEST □□□□□□□□
2 When this condition is detected during startup, the password is displayed.		Password 1234 □□□□□□□□□□□□□□□□
3 After the four keys are released, startup will continue.		TEST □□□□□□□□□□□□□□□□□□□□□

7 Settings

7.1 Parameter

The P130C must be adjusted to the system and to the protected equipment by means of appropriate settings. This section gives instructions for determining the settings, which are located in the folder entitled 'Parameters' in the menu tree. The sequence in which the settings are listed and described in this chapter corresponds to their sequence in the menu tree. The 'Address List' in the Appendix lists all parameters, along with setting ranges and incrementation or selection tables.

The units are supplied with a factory-set configuration of settings that in most cases correspond to the default settings given in the Address List. If the factory settings differ from the default settings, then this is indicated below at the appropriate points.

The default settings given in the Address List are activated after a cold restart. The P130C is blocked in that case. All settings must be re-entered after a cold restart.

7.1.1 Device Identification

The device identification settings are used to record the ordering information and the design version of the P130C. They have no effect on the device functions. These settings should only be changed if the design version of the P130C is modified.

Device

DVICE: Device type	000 000
The device type is displayed. This display cannot be altered.	
DVICE: Software version	002 120
Software version for the device. This display cannot be altered.	
DVICE: SW date	002 122
Date the software was created. This display cannot be altered.	
DVICE: SW version communic.	002 103
Software version for the device's communication software. This display cannot be altered.	
DVICE: Language version	002 123
Identification of the change level of the texts of the data model. This display cannot be altered.	
DVICE: Text vers.data model	002 121
Using the 'text replacement tool' provided by the operating program, the user can change the parameter descriptors (plain text designations) and load them into the device. These customized data models contain an identifier defined by the user while preparing the data model. This identifier is displayed at this point in the menu tree. Standard data models have the identifier '0' (factory-set default).	
DVICE: F number	002 124
The F number is the serial number of the device. This display cannot be altered.	
DVICE: Order No.	000 001
Order number of the device. This number cannot be altered by the user.	

DVICE: Order ext. No. 1	000 003
DVICE: Order ext. No. 2	000 004
DVICE: Order ext. No. 3	000 005
DVICE: Order ext. No. 4	000 006
DVICE: Order ext. No. 5	000 007
DVICE: Order ext. No. 6	000 008
DVICE: Order ext. No. 7	000 009
DVICE: Order ext. No. 8	000 010
DVICE: Order ext. No. 9	000 011
DVICE: Order ext. No. 10	000 012
DVICE: Order ext. No. 11	000 013
DVICE: Order ext. No. 12	000 014
DVICE: Order ext. No. 13	000 015
DVICE: Order ext. No. 14	000 016
DVICE: Order ext. No. 15	000 017
DVICE: Order ext. No. 16	000 018
DVICE: Order ext. No. 17	000 019
DVICE: Order ext. No. 18	000 020
DVICE: Order ext. No. 19	000 021
DVICE: Order ext. No. 20	000 022
DVICE: Order ext. No. 21	000 023
DVICE: Order ext. No. 22	000 024
DVICE: Order ext. No. 23	000 025
DVICE: Order ext. No. 24	000 026
DVICE: Order ext. No. 25	000 027
DVICE: Order ext. No. 26	000 028
DVICE: Order ext. No. 27	000 029
Order extension numbers for the device.	
DVICE: Module var. slot 1	086 050
DVICE: Module var. slot 2	086 051
Item number of the module inserted in the respective slot. The display always shows the actual component configuration at any given time.	
DVICE: Module vers. slot 1	086 193
DVICE: Module vers. slot 2	086 194
Index letter specifying the version of the module inserted in the respective slot.	
DVICE: Variant of module A	086 047
Item number of module A in this design version.	
DVICE: Version of module A	086 190
Index letter specifying the version of module A.	

DVICE: Customer ID data 1	000040
DVICE: Customer ID data 2	000041
DVICE: Customer ID data 3	000042
DVICE: Customer ID data 4	000043
DVICE: Customer ID data 5	000044
DVICE: Customer ID data 6	000045
DVICE: Customer ID data 7	000046
DVICE: Customer ID data 8	000047
Set your numerically coded user data here for your records.	
DVICE: Device ID	000035
ID code used by the operating program for identification purposes. See description of the respective operating program for more detailed setting instructions.	
DVICE: Substation ID	000036
ID code used by the operating program for identification purposes. See description of the respective operating program for more detailed setting instructions.	
DVICE: Feeder ID	000037
ID code used by the operating program for identification purposes. See description of the respective operating program for more detailed setting instructions.	
DVICE: Device password 1	000048
DVICE: Device password 2	000049
ID code used by the operating program for identification purposes. See description of the respective operating program for more detailed setting instructions.	

7.1.2 Configuration Parameters

Local control panel

LOC: Language	003 020	
Language in which texts will be displayed on the local control panel.		
LOC: Decimal delimiter	003 021	
Character to be used as decimal delimiter on the local control panel.		
LOC: Password	003 035	
The password to be used for changing settings from the local control panel can be defined here. Further information on changing the password is given in Chapter 6.		
LOC: Fct. read key	080 110	
Selection of up to 16 functions to be triggered when pressing the read key. Event counters and event recordings are offered for selection. If several functions have been selected then they will be sequentially triggered by repeated pressing of the read key.		
LOC: Fct. menu jmp list 1	030 238	
LOC: Fct. menu jmp list 2	030 239	
Compilation of functions for the two menu jump lists. One of these menu jump lists can be assigned to a function key by selecting the entry LOC: Trig. menu jmp x EXT (x: 1 or 2) at F_KEY: Fct. assignm. Fx (Fx: F1, F2, F3 or F4). Up to 16 functions can be selected as described for LOC: Fct. read key. Repeated pressing (in this case of the assigned function key rather than the read key) will then sequentially trigger the selected functions.		
LOC: Fct. Operation Panel	053 007	Fig. 3-2
Definition of the values to be displayed on the Measured Value Panel referred to as the Operation Panel.		
LOC: Fct. Overload Panel	053 005	Fig. 3-5
Definition of the values to be displayed on the Overload Panel.		
LOC: Fct. Grd.Fault Panel	053 004	Fig. 3-4
Definition of the values to be displayed on the Ground Fault Panel.		
LOC: Fct. Fault Panel	053 003	Fig. 3-3
Definition of the values to be displayed on the Fault Panel.		
LOC: Hold-time for Panels	031 075	Fig. 3-2
Setting for the time period for which a panel is displayed before the unit switches to the next panel. This setting is only relevant if more values are selected for display than can be shown on the LCD display.		
LOC: Autom. return time	003 014	Fig. 3-2
If the user does not press a key on the local control panel during this set time period, the change-enabling function is deactivated.		
LOC: Return time illumin.	003 023	
If the user does not press a key on the local control panel during this set time period, then the backlighting of the LCD display is switched off.		

PC link

PC: Name of manufacturer 003 183 Fig. 3-6

Setting for the name of the manufacturer.

Note: This setting can be changed to ensure compatibility.

PC: Bay address 003 068 Fig. 3-6
PC: Device address 003 069 Fig. 3-6

Bay and device addresses are used to address the device in communication via the PC interface. An identical setting must be selected for both addresses.

PC: Baud rate 003 081 Fig. 3-6

Baud rate of the PC interface.

PC: Parity bit 003 181 Fig. 3-6

Set the same parity that is set at the interface of the PC connected to the P130C.

PC: Spontan. sig. enable 003 187 Fig. 3-6

Enable for the transmission of spontaneous signals via the PC interface.

PC: Select. spontan.sig. 003 189 Fig. 3-6

Selection of spontaneous signals for transmission via the PC interface.

PC: Transm.enab.cycl.dat 003 084 Fig. 3-6

Enable for the cyclic transmission of measured values via the PC interface.

PC: Cycl. data ILS tel. 003 185 Fig. 3-6

Selection of the measured values that are transmitted in a user-defined telegram via the PC interface.

PC: Delta V 003 055 Fig. 3-6

A measured voltage value is transmitted via the PC interface if it differs by the set delta quantity from the last measured value transmitted.

PC: Delta I 003 056 Fig. 3-6

A measured current value is transmitted via the PC interface if it differs by the set delta quantity from the last measured value transmitted.

PC: Delta P 003 059 Fig. 3-6

The active power value is transmitted via the PC interface if it differs by the set delta quantity from the last measured value transmitted.

PC: Delta f 003 057 Fig. 3-6

The measured frequency value is transmitted via the PC interface if it differs by the set delta from the last measured value transmitted.

PC: Delta meas.v.ILS tel 003 155 Fig. 3-6

The telegram is transmitted if a measured value differs by the set delta quantity from the last measured value transmitted.

PC: Delta t 003 058 Fig. 3-6

All measured data are transmitted again through the PC interface after this time period has elapsed – provided that transmission has not been triggered by the other delta conditions.

PC: Time-out Setting for the time to elapse after the last telegram exchange via the PC interface before activating the second communication channel of communication module A.	003 188	Fig. 3-6

"Logical" communication interface 1

COMM1: Function group COMM1 Canceling function group COMM1 or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.	056 026	
COMM1: General enable USER Disabling or enabling "logical" communication interface 1.	003 170	Fig. 3-7
COMM1: Basic IEC870-5enable Common settings for enabling all protocols based on IEC 870-5-xxx.	003 215	Fig. 3-7
COMM1: Addit. -101 enable Enabling additional settings that are relevant for the protocol based on IEC 870-5-101.	003 216	Fig. 3-7
COMM1: Addit. ILS enable Enabling additional settings that are relevant for the ILS protocol.	003 217	Fig. 3-7
COMM1: MODBUS enable Enabling settings relevant for the MODBUS protocol.	003 220	Fig. 3-7
COMM1: DNP3 enable Enabling settings relevant for the DNP 3.0 protocol.	003 231	Fig. 3-7
COMM1: COURIER enable Enabling settings relevant for the COURIER protocol.	103 040	
COMM1: Communicat. protocol Select the communication protocol that shall be used for the communication interface.	003 167	Fig. 3-7
COMM1: MODBUS prot. variant The user may select either the ALSTOM D or the ALSTOM variant of the MODBUS protocol. **Note:** This setting is hidden unless the MODBUS protocol is enabled.	003 214	Fig. 3-11
COMM1: Line idle state Setting for the line idle state indication.	003 165	Fig. 3-8, 3-9, 3-10,3-11, 3-12
COMM1: Baud rate Baud rate of the communication interface.	003 071	Fig. 3-8,3-9,3-10,3-11,3-12
COMM1: Parity bit Set the same parity that is set at the interface of the control system connected to the P130C.	003 171	Fig. 3-8,3-9,3-10,3-11,3-12

COMM1: Dead time monitoring 003 176	Fig. 3-8,3-9,3-10,3-11,3-12
The P130C monitors telegram transmission to make sure that no excessive pause occurs within a telegram. This monitoring function can be disabled if it is not required. **Note:** This setting is only necessary for modem transmission.	
COMM1: Mon. time polling 003 202	Fig. 3-8,3-9,3-10,3-11,3-12
The time between two polling calls from the communication master must be less than the time set here.	
COMM1: Octet comm. address 003 072	Fig. 3-8,3-9,3-10,3-11,3-12
The communication address and the ASDU address are used to identify the device in communication via the interface. An identical setting must be selected for both addresses. **Note:** The former designation for 'COMM1: Octet comm. address' was ILSA: Bay address "ASDU": Application Service Data Unit	
COMM1: Oct.2 comm.addr.DNP3 003 240	Fig. 3-12
In the DNP 3.0 protocol, a 16 bit address is used to identify devices. The address that can be set here is the higher-order octet, whereas the address set at COMM1: Octet comm. address is the lower-order octet of the DNP address. **Note:** This setting is hidden unless the DNP 3.0 protocol is enabled.	
COMM1: Test monitor on 003 166	Fig. 3-8,3-9,3-10,3-11,3-12
Setting specifying whether data shall be recorded for service activities.	
COMM1: Name of manufacturer 003 161	Fig. 3-8,3-9,3-10
Setting for the name of the manufacturer (to ensure compatibility). **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.	
COMM1: Octet address ASDU 003 073	Fig. 3-8,3-9,3-10
The communication address and the ASDU address are used to identify the device in communication via the interface. An identical setting must be selected for both addresses. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled. The former designation for 'COMM1: Octet address ASDU' was 'ILSA: Device address'. "ASDU": Application Service Data Unit	

COMM1: Spontan. sig. enable	003 177	Fig. 3-8,3-9,3-10
Enable for the transmission of spontaneous signals via the communication interface. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.		
COMM1: Select. spontan.sig.	003 179	Fig. 3-8,3-9,3-10,3-15
Selection of spontaneous signals for transmission via "logical" communication interface 1.		
COMM1: Transm.enab.cycl.dat	003 074	Fig. 3-8,3-9,3-10
Enabling of cyclic transmission of measured values via the communication interface. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.		
COMM1: Cycl. data ILS tel.	003 175	Fig. 3-8,3-9,3-10
Selection of the measured values transmitted in a user-defined telegram via the communication interface. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.		
COMM1: Delta V	003 050	Fig. 3-8,3-9,3-10
A measured voltage value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.		
COMM1: Delta I	003 051	Fig. 3-8,3-9,3-10
A measured current value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.		
COMM1: Delta P	003 054	Fig. 3-8,3-9,3-10
The active power value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.		
COMM1: Delta f	003 052	Fig. 3-8,3-9,3-10
The measured frequency is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.		
COMM1: Delta meas.v.ILS tel	003 150	Fig. 3-8,3-9,3-10
The telegram is transmitted if a measured value differs by the set delta quantity from the last measured value transmitted. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.		

COMMM1: Delta t 003 053 Fig. 3-8,3-9,3-10

All measured data are transmitted again through the communication interface after this time period has elapsed – provided that transmission has not been triggered by the other delta conditions.

Note: This setting is hidden unless an IEC 870-5 protocol is enabled.

COMM1: Delta t (energy) 003 151 Fig. 3-8,3-9,3-10

The measured data for active energy and reactive energy are transmitted through the communication interface after this time has elapsed.

Note: This setting is hidden unless an IEC 870-5 protocol is enabled.

COMM1: Contin. general scan 003 077 Fig. 3-8,3-9,3-10

A continuous or background general scan means that the P130C transmits all settings, signals, and monitoring signals through the communication interface during slow periods when there is not much activity. This ensures that there will be data consistency with a connected control system. The time to be set defines the minimum time difference between two telegrams.

Note: This setting is hidden unless an IEC 870-5 protocol is enabled.

COMM1: Comm. address length 003 201 Fig. 3-9

Setting for the communication address length.

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

COMM1: Octet 2 comm. addr. 003 200 Fig. 3-9

Setting for the length of the higher-order communication address.

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

COMM1: Cause transm. length 003 192 Fig. 3-9

Setting for the length of the cause of transmission.

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

COMM1: Address length ASDU 003 193 Fig. 3-9

Setting for the length of the common address for identification of telegram structures.

Note:

This setting is hidden unless the IEC 870-5-101 protocol is set.

"ASDU": Application Service Data Unit

COMM1: Octet 2 addr. ASDU 003 194 Fig. 3-9

Setting for the length of the common higher-order address for identification of telegram structures.

Note:

This setting is hidden unless the IEC 870-5-101 protocol is set.

"ASDU": Application Service Data Unit

COMM1: Addr.length inf.obj. 003 196 Fig. 3-9

Setting for the length of the address for information objects.

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

COMM1: Oct.3 addr. inf.obj. 003 197 Fig. 3-9

Setting for the length of the higher-order address for information objects.

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

COMM1: Inf.No.<->funct.type 003 195 Fig. 3-9

Setting specifying whether information numbers and function type shall be reversed in the object address.

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

COMM1: Time tag length 003 198 Fig. 3-9

Setting for the time tag length.

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

COMM1: ASDU1 / ASDU20 conv. 003 190 Fig. 3-9

Setting specifying whether telegram structure 1 or 20 shall be converted as a single signal or double signal.

Note:

This setting is hidden unless the IEC 870-5-101 protocol is set.

"ASDU": Application Service Data Unit

COMM1: ASDU2 conversion 003 191 Fig. 3-9

Setting specifying whether telegram structure 2 shall be converted as a single signal or double signal.

Note:

This setting is hidden unless the IEC 870-5-101 protocol is set.

"ASDU": Application Service Data Unit

COMM1: Initializ. signal 003 199 Fig. 3-9

Setting specifying whether an initialization signal shall be issued.

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

COMM1: Balanced operation 003 226 Fig. 3-9

Setting that determines whether communication takes place on a balanced basis (full duplex operation).

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

COMM1: Direction bit 003 227 Fig. 3-9

Setting for the transmission direction. Normally this value will be set at '1' at the control center and at '0' at the substation.

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

COMM1: Time-out interval 003 228 Fig. 3-9

Setting for the maximum time that will elapse until the status signal for the acknowledgment command is issued.

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

COMMM1: Reg.asg. selec. cmds 003 210 Fig. 3-11

MODBUS registers in the range 00301 to 00400 are assigned to the selected commands. Assignment is made in the order of selection. This means that the first command is given the register no. 00301, the second the register no. 00302, etc.

Note: This setting is hidden unless the MODBUS protocol is enabled.

COMM1: Reg.asg. selec. sig. 003 211 Fig. 3-11

MODBUS registers in the range 10301 to 10400 are assigned to the selected signals. Assignment is made in the order of selection. This means that the first signal is given the register no. 10301, the second the register no. 10302, etc.

Note: This setting is hidden unless the MODBUS protocol is enabled.

COMM1: Reg.asg. sel. m.val. 003 212 Fig. 3-11

MODBUS registers in the range 30301 to 30400 are assigned to the selected measured values. Assignment is made in the order of selection. This means that the first measured value is given the register no. 30301, the second the register no. 30302, etc.

Note: This setting is hidden unless the MODBUS protocol is enabled.

COMM1: Reg.asg. sel. param. 003 213 Fig. 3-11

MODBUS registers in the range 40301 to 40400 are assigned to the selected parameters. Assignment is made in the order of selection. This means that the first parameter is given the register no. 40301, the second the register no. 40302, etc.

Note: This setting is hidden unless the MODBUS protocol is enabled.

COMM1: Delta t (MODBUS) 003 152 Fig. 3-11

All MODBUS registers are transmitted again through the communication interface after this time has elapsed.

Note: This setting is hidden unless the MODBUS protocol is enabled.

COMM1: Autom.event confirm. 003 249 Fig. 3-11

Setting specifying whether an event must be confirmed by the master in order for an event to be deleted from the 'event queue'.

Note: This setting is hidden unless the MODBUS protocol is enabled.

COMM1: Phys. Charact. Delay 003 241 Fig. 3-12

Number of bits that must pass between the receipt of the 'request' and the start of sending the 'response'.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Phys. Char. Timeout 003 242 Fig. 3-12

Number of bits that may be missing from the telegram before receipt is terminated.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Link Confirm. Mode 003 243 Fig. 3-12

Setting for the acknowledgment mode of the link layer.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Link Confirm.Timeout 003 244 Fig. 3-12

Setting for the time period within which the master must acknowledge at the link layer.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Link Max. Retries 003 245 Fig. 3-12

Number of repetitions that are carried out on the link layer if errors have occurred during transmission (such as failure to acknowledge).

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Appl.Confirm.Timeout 003 246 Fig. 3-12

Setting for the time period within which the master must acknowledge at the application layer.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Appl. Need Time Del. 003 247 Fig. 3-12

Time interval within which the slave requests time synchronization cyclically from the master.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Ind./cl. bin. inputs 003 232 Fig. 3-12

Selection of data points and data classes for object 1 – binary inputs. Assignment of indices is made in the order of selection, beginning with 0.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Ind./cl. bin.outputs 003 233 Fig. 3-12

Selection of data points and data classes for object 10 – binary outputs. Assignment of indices is made in the order of selection, beginning with 0.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Ind./cl. analog inp. 003 235 Fig. 3-12

Selection of data points and data classes for object 30 – analog inputs. Assignment of indices is made in the order of selection, beginning with 0.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Ind./cl. analog outp 003 236 Fig. 3-12

Selection of data points and data classes for object 40 – analog outputs. Assignment of indices is made in the order of selection, beginning with 0.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Delta meas.v. (DNP3) 003 250 Fig. 3-12

Initialization value of threshold values for transmission of measured values in object 30. The threshold values can be changed separately by the master for each measured value by writing to object 34, 'analog input reporting deadband'.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Delta t (DNP3) 003 248 Fig. 3-12

Cycle time for updating DNP object 30 (analog inputs).

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Command selection 103 042

Selection of commands to be issued via the COURIER protocol.

Note: This setting is hidden unless the COURIER protocol is enabled.

COMM1: Signal selection 103 043

Selection of signals to be transmitted via the COURIER protocol.

Note: This setting is hidden unless the COURIER protocol is enabled.

COMM1: Meas. val. selection 103 044

Selection of measured values to be transmitted via the COURIER protocol.

Note: This setting is hidden unless the COURIER protocol is enabled.

COMM1: Parameter selection 103 045

Selection of settings to be altered via the COURIER protocol.

Note: This setting is hidden unless the COURIER protocol is enabled.

COMM1: Delta t (COURIER) 103 046

Cycle for re-transmission of the selected measured values.

Note: This setting is hidden unless the COURIER protocol is enabled.

"Logical" communication interface 2

COMM2: Function group COMM2 056 057

Canceling function group COMM2 or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

COMM2: General enable USER 103 170 Fig. 3-15

Disabling or enabling "logical" communication interface 2.

COMM2: Line idle state 103 165 Fig. 3-15

Setting for the line idle state indication.

COMM2: Baud rate 103 071 Fig. 3-15

Baud rate of the communication interface.

COMM2: Parity bit 103 171 Fig. 3-15

Set the same parity that is set at the interface of the control system connected to the P130C.

COMM2: Dead time monitoring 103 176 Fig. 3-15

The P130C monitors telegram transmission to make sure that no excessive pause occurs within a telegram. This monitoring function can be disabled if it is not required.

Note: This setting is only necessary for modem transmission.

COMM2: Mon. time polling 103 202 Fig. 3-15

The time between two polling calls from the communication master must be less than the time set here.

COMM2: Octet comm. address 103 072 Fig. 3-15

The communication address and the ASDU address are used to identify the device in communication via the interface. An identical setting must be selected for both addresses.

"ASDU": Application Service Data Unit

COMM2: Name of manufacturer 103 161 Fig. 3-15

Setting for the name of the manufacturer.

Note: This setting can be changed to ensure compatibility.

COMM2: Octet address ASDU 103 073 Fig. 3-15

The communication address and the ASDU address are used to identify the device in communication via the interface. An identical setting must be selected for both addresses.

"ASDU": Application Service Data Unit

COMM2: Spontan. sig. enable 103 177 Fig. 3-15

Enable for the transmission of spontaneous signals via the communication interface.

COMM2: Select. spontan.sig. 103 179

Selection of the spontaneous signals for transmission via logical communication interface 2.

COMM2: Transm.enab.cycl.dat 103 074 Fig. 3-15

Enabling of cyclic transmission of measured values via the communication interface.

COMM2: Cycl. data ILS tel.	103 175 Fig. 3-15
Selection of the measured values transmitted in a user-defined telegram via the communication interface.	
COMM2: Delta V	103 050 Fig. 3-15
A measured voltage value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.	
COMM2: Delta I	103 051 Fig. 3-15
A measured current value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.	
COMM2: Delta P	103 054 Fig. 3-15
The active power value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.	
COMM2: Delta f	103 052 Fig. 3-15
The measured frequency is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.	
COMM2: Delta meas.v.ILS tel	103 150 Fig. 3-15
The telegram is transmitted if a measured value differs by the set delta quantity from the last measured value transmitted.	
COMM2: Delta t	103 053 Fig. 3-15
All measured data are transmitted again through the communication interface after this time period has elapsed – provided that transmission has not been triggered by the other delta conditions.	

"Logical" communication interface 3

COMM3: Function group COMM3	056 058
Canceling function group COMM3 or including it in the configuration. This setting parameter is only visible if the relevant optional communication module is fitted. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.	
COMM3: General enable USER	120 030
Disabling or enabling "logical" communication interface 3.	
COMM3: Baud rate	120 038
Adjustment of the baud rate for telegram transmission via the guidance interface (InterMiCOM interface) so as to meet the requirements of the transmission carrier.	
COMM3: Source address	120 031
Address for send signals.	
COMM3: Receiving address	120 032
Address for receive signals.	
COMM3: Fct. assignm. send 1 COMM3: Fct. assignm. send 2 COMM3: Fct. assignm. send 3 COMM3: Fct. assignm. send 4 COMM3: Fct. assignm. send 5 COMM3: Fct. assignm. send 6 COMM3: Fct. assignm. send 7 COMM3: Fct. assignm. send 8	121 001 121 003 121 005 121 007 121 009 121 011 121 013 121 015
Assignment of functions for the 8 send signals.	
COMM3: Fct. assignm. rec. 1 COMM3: Fct. assignm. rec. 2 COMM3: Fct. assignm. rec. 3 COMM3: Fct. assignm. rec. 4 COMM3: Fct. assignm. rec. 5 COMM3: Fct. assignm. rec. 6 COMM3: Fct. assignm. rec. 7 COMM3: Fct. assignm. rec. 8	120 001 120 004 120 007 120 010 120 013 120 016 120 019 120 022
Configuration (assignment of functions) for the 8 receive signals	
COMM3: Oper. mode receive 1 COMM3: Oper. mode receive 2 COMM3: Oper. mode receive 3 COMM3: Oper. mode receive 4	120 002 120 005 120 008 120 011
Selection of *Blocking* or *Direct intertrip* for the operating mode of receive signals 1 to 4 (single-pole transmission).	
COMM3: Oper. mode receive 5 COMM3: Oper. mode receive 6 COMM3: Oper. mode receive 7 COMM3: Oper. mode receive 8	120 014 120 017 120 020 120 023
Selection of *Permissive or Direct intertrip* for the operating mode of receive signals 5 to 8 (two-pole transmission).	

COMM3: Default value rec. 1	120 060	
COMM3: Default value rec. 2	120 061	
COMM3: Default value rec. 3	120 062	
COMM3: Default value rec. 4	120 063	
COMM3: Default value rec. 5	120 064	
COMM3: Default value rec. 6	120 065	
COMM3: Default value rec. 7	120 066	
COMM3: Default value rec. 8	120 067	
Definition of the default value for the 8 receive signals.		
COMM3: Time-out comm.fault	120 033	Fig. 3-18
This timer triggers the alarm signals COMM3: Communications fault and SFMON: Communic.fault COMM3 and sets the received signals to their user-defined default values. Time-out occurs when the set time has elapsed since the most recent 100% valid telegram was received.		
COMM3: Sig.asg. comm.fault	120 034	
Using this setting, the alarm signal can be configured (assigned) to the corresponding PSIG input signal.		
COMM3: Time-out link fail.	120 035	Fig. 3-18
Time indicating a persistent failure of the transmission channel. After this timer stage has elapsed, alarm signals COMM3: Comm. link failure and SFMON: Comm.link fail.COMM3 are raised. These can be mapped to give the operator a warning LED or contact to indicate that maintenance attention is required.		
COMM3: Limit telegr. errors	120 036	
Percentage of corrupted messages compared to total messages transmitted before an alarm is raised (COMM3: Lim.exceed.,tel.err. and SFMON: Lim.exceed.,tel.err.). When this threshold is exceeded, the receive signals are set to their user-defined default values.		

IRIG-B interface

IRIGB: Function group IRIGB	056 072	
Canceling function group IRIGB or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.		
IRIGB: General enable USER	023 200	Fig. 3-19
Disabling or enabling the IRIG-B interface.		

Function keys

F_KEY: Password funct. key1 003 036
F_KEY: Password funct. key2 030 242
F_KEY: Password funct. key3 030 243
F_KEY: Password funct. key4 030 244

These passwords enable the corresponding function keys. Further information on changing the passwords is given in Chapter 6.

F_KEY: Fct. assignm. F1 080 112 Fig. 3-20
F_KEY: Fct. assignm. F2 080 113
F_KEY: Fct. assignm. F3 080 114
F_KEY: Fct. assignm. F4 080 115

Assignment of functions to the function keys. Either a single function or a menu jump list may be selected. The two menu jump lists are composed via LOC: Fct. menu jmp list x (x: 1 or 2).

F_KEY: Operating mode F1 080 132 Fig. 3-20
F_KEY: Operating mode F2 080 133
F_KEY: Operating mode F3 080 134
F_KEY: Operating mode F4 080 135

Choice between operation of the function key as a key or switch.

F_KEY: Return time fct.keys 003 037

Once the password has been entered, the function keys remain active for no longer than this time. Thereafter, the function keys are disabled until the password is entered again.

Binary inputs

The P130C has optical coupler inputs for processing binary signals from the substation. The number and connection schemes for the available binary inputs are shown in the terminal connection diagrams. The Address List in the Appendix gives information about the configuration options for all binary inputs.

When configuring binary inputs, one should keep in mind that the same function can be assigned to several signal inputs. Thus one function can be activated from several control points having different signal voltages.

In order to ensure that the device will recognize the input signals, the triggering signals must persist for at least 30 ms.

The operating mode for each binary signal input can be defined. The user can specify whether the presence (*active 'high'* mode) or absence (*active 'low'* mode) of a voltage shall be interpreted as the logic '1' signal.

INP: Fct. assignm. U 1	178 002
INP: Fct. assignm. U 2	178 006
Assignment of functions to binary signal inputs.	
INP: Oper. mode U 1	178 003
INP: Oper. mode U 2	178 007
Selection of operating mode for binary signal inputs.	

Binary outputs

The P130C has output relays for the output of binary signals. The number and connection schemes for the available output relays are shown in the terminal connection diagrams. The Address List in the Appendix gives information about the configuration options for all binary outputs.

The contact data for the all-or-nothing relays permits them to be used either as command relays or as signal relays. One signal can also be assigned to several output relays simultaneously for the purpose of contact multiplication.

An operating mode can be defined for each output relay. Depending on the selected operating mode, the output relay will operate in either an energize-on-signal (ES) mode or a normally-energized (NE) mode and in either a latching or non-latching mode. For output relays operating in latching mode, the operating mode setting also determines when latching will be canceled.

Note: For relays with make contacts, the energize-on-signal (ES) mode corresponds to normally-open operation. The normally-energized (NE) mode means that the polarity of the driving signal is inverted, such that a logic "0" maintains the relay normally-closed. For relays with changeover contacts, these more common descriptions are not applicable.

OUTP: Fct. assignm. K 1	157 002
OUTP: Fct. assignm. K 2	157 006
OUTP: Fct. assignm. K 3	157 010
OUTP: Fct. assignm. K 4	157 014
OUTP: Fct. assignm. K 5	157 018
OUTP: Fct. assignm. K 6	157 022
OUTP: Fct. assignm. K 7	157 026
OUTP: Fct. assignm. K 8	157 030
Assignment of functions to output relays.	
OUTP: Oper. mode K 1	157 003
OUTP: Oper. mode K 2	157 007
OUTP: Oper. mode K 3	157 011
OUTP: Oper. mode K 4	157 015
OUTP: Oper. mode K 5	157 019
OUTP: Oper. mode K 6	157 023
OUTP: Oper. mode K 7	157 027
OUTP: Oper. mode K 8	157 031
Selection of operating mode for output relays.	

LED indicators

The P130C has a total of 17 LED indicators for parallel display of binary signals. The Address List in the Appendix gives information about the configuration options for all LED indicators. The following table provides an overview.

LED indicator	Description on the label strip as supplied	Configuration
H 1	'HEALTHY'	Not configurable. H 1 signals the operational readiness of the device (supply voltage present).
H 17	'EDIT MODE'	Not configurable. H 17 signals the fact that the user is in the 'EDIT MODE'. In this mode, parameter values can be changed. (See the section entitled 'Display and Keypad' in Chapter 6.)
H 2	'OUT OF SERVICE'	Permanently assigned to the function MAIN: Blocked/faulty.
H 3	'ALARM'	Permanently assigned to the function SFMON: Warning (LED).
H 4	'TRIP'	The factory-set configuration is shown in the Terminal Connection Diagrams. These diagrams are found in the appendix to this manual or in the Supporting Documents shipped with the device.
H 5 to H 16	----	The user has the option of assigning functions to these LED indicators.

The arrangement of the LED indicators on the local control panel is illustrated in the dimensional drawings of Chapter 4.

An operating mode can be defined for each LED indicator. Depending on the selected operating mode, the output relay will operate in either energize-on-signal (ES) mode or normally-energized (NE) mode and in either latching or non-latching mode. For LED indicators operating in latching mode, the operating mode setting also determines when latching will be canceled.

Note: For relays with make contacts, the energize-on-signal (ES) mode corresponds to normally-open operation. The normally-energized (NE) mode means that the polarity of the driving signal is inverted, such that a logic "0" maintains the relay normally-closed. For relays with changeover contacts, these more common descriptions are not applicable.

LED: Fct. assignm. H 2	085 001
Display of the function assigned to LED indicator H 2 ('OUT OF SERVICE'). The MAIN: Blocked/faulty function is permanently assigned to this LED.	
LED: Fct. assignm. H 3	085 004
Display of the function assigned to LED indicator H 3 ('ALARM'). The SFMON: Warning (LED) function is permanently assigned to this LED.	
LED: Fct. assignm. H 4	085 007
LED: Fct. assignm. H 5	085 010
LED: Fct. assignm. H 6	085 013
LED: Fct. assignm. H 7	085 016
LED: Fct. assignm. H 8	085 019
LED: Fct. assignm. H 9	085 022
LED: Fct. assignm. H 10	085 025
LED: Fct. assignm. H 11	085 028
LED: Fct. assignm. H 12	085 031
LED: Fct. assignm. H 13	085 034
LED: Fct. assignm. H 14	085 037
LED: Fct. assignm. H 15	085 040
LED: Fct. assignm. H 16	085 043
Assignment of functions to LED indicators.	
LED: Operating mode H 2	085 002
LED: Operating mode H 3	085 005
LED: Operating mode H 4	085 008
LED: Operating mode H 5	085 011
LED: Operating mode H 6	085 014
LED: Operating mode H 7	085 017
LED: Operating mode H 8	085 020
LED: Operating mode H 9	085 023
LED: Operating mode H 10	085 026
LED: Operating mode H 11	085 029
LED: Operating mode H 12	085 032
LED: Operating mode H 13	085 035
LED: Operating mode H 14	085 038
LED: Operating mode H 15	085 041
LED: Operating mode H 16	085 044
Selection of operating mode for LED indicators.	

Main function

MAIN: Chann.assign.COMM1/2	003 169
Assignment of "logical" communication interfaces to physical communication channels.	

Fault recording

FT_RC: Rec. analog chann. 1	035 160
FT_RC: Rec. analog chann. 2	035 161
FT_RC: Rec. analog chann. 3	035 162
FT_RC: Rec. analog chann. 4	035 163
FT_RC: Rec. analog chann. 5	035 164
FT_RC: Rec. analog chann. 6	035 165
FT_RC: Rec. analog chann. 7	035 166
The user specifies the channel on which each physical variable is recorded.	

Canceling protection functions

By means of a configuration procedure, the user can adapt the device functions flexibly to the scope of protection functions required in each particular h.v. system.

The following conditions must be met before a protection function can be canceled:

- The protection function in question must be disabled.
- None of the functions of the protection function being canceled may be assigned to a binary input.
- None of the signals of the protection function may be assigned to a binary output or to an LED indicator.
- None of the signals of the protection function may be linked to other signals by way of an 'm out of n' parameter.

The protection function to which a parameter, a signal, or a measured value belongs is defined by the function group designation (example: 'LIMIT').

Definite-time overcurrent protection

DTOC: Function group DTOC	056 008
Canceling function group DTOC or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.	

Inverse-time overcurrent protection

IDMT: Function group IDMT	056 009
Canceling function group IDMT or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.	

Short-circuit direction determination

SCDD: Function group SCDD	056 021
Canceling function group SCDD or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.	

Switch on to fault protection

SOTF: Function group SOTF	056 003
Canceling function group SOTF or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.	

Protective signaling

PSIG: Function group PSIG	056 004
Canceling function group PSIG or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.	

Auto-reclosing control

ARC: Function group ARC 056 005

Canceling function group ARC or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Ground fault direction determination using steady-state values

GFDSS: Function group GFDSS 056 012

Canceling function group GFDSS or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Motor protection

MP: Function group MP 056 022

Canceling function group MP or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Thermal overload protection

THERM: Function group THERM 056 023

Canceling function group THERM or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Unbalance protection

I2>: Function group I2> 056 024

Canceling function group I2> or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Time-voltage protection

V<>: Function group V<> 056 010

Canceling function group V<> or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Over-/underfrequency protection

f<>: Function group f<> 056 033

Canceling function group f<> or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Power directional protection

P<>: Function group P<> 056 045

Canceling function group P<> or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Circuit breaker failure protection

CBF: Function group CBF 056 007

Canceling function group CBF or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Measuring-circuit monitoring

MCMON: Function group MCMON 056 015

Canceling function group MCMON or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Limit value monitoring

LIMIT: Function group LIMIT 056 025

Canceling function group LIMIT or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Logic

LOGIC: Function group LOGIC 056 017

Canceling function group LOGIC or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

7.1.3 Function Parameters

7.1.3.1 Global

PC link

PC: Command blocking	003 182	Fig. 3-6
When command blocking is activated, commands are rejected at the PC interface.		
PC: Sig./meas.val.block.	003 086	Fig. 3-6
When signal and measured value blocking is activated, no signals or measured data are transmitted through the PC interface.		

"Logical" communication interface 1

COMM1: Command block. USER	003 172	Fig. 3-7
When command blocking is activated, commands are rejected at communication interface 1.		
COMM1: Sig./meas.block.USER	003 076	Fig. 3-8,3-9,3-10
When signal and measured value blocking is activated, no signals or measured data are transmitted through communication interface 1.		

"Logical" communication interface 2

COMM2: Command block. USER	103 172	Fig. 3-15
When command blocking is activated, commands are rejected at communication interface 2.		
COMM2: Sig./meas.block.USER	103 076	Fig. 3-15
When signal and measured value blocking is activated, no signals or measured data are transmitted through communication interface 2.		

Binary outputs

OUTP: Outp.rel.block USER	021 014	Fig. 3-22
When this blocking is activated, all output relays are blocked.		

Main function

MAIN: Device on-line	003 030	Fig. 3-36
Disabling or enabling protection. Parameters marked *'No (=off)'* in the Address List can only be changed when protection is disabled.		
MAIN: Test mode USER	003 012	Fig. 3-54
When the test mode is activated, signals or measured data for PC and communication interfaces are labeled 'test mode'.		
MAIN: Nominal frequ. fnom	010 030	Fig. 3-182
Setting for the nominal frequency of the protected system.		
MAIN: Rotary field	010 049	Fig. 3-109, 3-168, 3-173, 3-192
Setting for the rotary field direction, either clockwise or anticlockwise.		
MAIN: Inom C.T. prim.	010 001	Fig. 3-26, 3-77
Setting for the primary nominal current of the main current transformers for measurement of phase currents.		

MAIN: IN,nom C.T. prim.	010 018	Fig. 3-27
Setting for the primary nominal current of the main current transformer for measurement of residual current.		
MAIN: Vnom V.T. prim.	010 002	Fig. 3-30,3-77
Setting for the primary nominal voltage of the system transformer for measurement of phase-to-ground and phase-to-phase voltages.		
MAIN: Inom device	010 003	Fig. 3-25
Setting for the secondary nominal current of the system transformer for measurement of phase currents. This also corresponds to the nominal device current.		
MAIN: IN,nom device	010 026	Fig. 3-25
Setting for the secondary nominal current of the system transformer for measurement of residual current. This also corresponds to the nominal device current.		
MAIN: Vnom V.T. sec.	010 009	Fig. 3-25
Setting for the secondary nominal voltage of the system transformer for measurement of phase-to-ground and phase-to-phase voltages.		
MAIN: Conn. meas. circ. IP	010 004	Fig. 3-25
Direction determination is governed by the connection of the measuring circuits. If the connection is as shown in Chapter 5, then the setting must be '*Standard*' if the P130C's 'Forward' decision is to be in the direction of the outgoing feeder.. If the connection direction is reversed or – given a connection scheme according to Chapter 5 – if the 'forward' decision is to be in the busbar direction, then the setting must be *'Opposite'*.		
MAIN: Conn. meas. circ. IN	010 019	Fig. 3-25
The direction determination function of the ground fault measuring systems is governed by the connection of the measuring circuits. If the connection is as shown in Chapter 5, then the setting must be '*Standard*' if the P130C's 'Forward' decision is to be in the direction of the outgoing feeder. If the connection direction is reversed or – given a connection scheme according to Chapter 5 – if the 'forward' decision is to be in the busbar direction, then the setting must be *'Opposite'*.		
MAIN: Meas. value rel. IP	011 030	Fig. 3-26
Setting for the minimum current that must be exceeded in order for the measured operating values of the phase currents – and the currents derived from them – to be displayed.		
MAIN: Meas. value rel. IN	011 031	Fig. 3-27
Setting for the minimum current that must be exceeded in order for the measured operating value of the residual current to be displayed.		
MAIN: Meas. value rel. V	011 032	Fig. 3-30
Setting for the minimum voltage that must be exceeded in order for the measured operating values of the phase-to-ground voltages, phase-to-phase voltages, and the voltages derived from them to be displayed.		
MAIN: Op. mode energy cnt.	010 138	Fig. 3-34
Selection of the procedure for the determination of the active and reactive energy output. Procedure 1: Acquisition every second (approximately) Procedure 2: Acquisition every 100 ms (approximately)		

MAIN: Settl. t. IP,max,del	010 113 Fig. 3-26
Setting for the time after which the delayed maximum current display shall reach 95% of the maximum current $I_{P,max}$.	
MAIN: Fct.assign. block. 1	021 021 Fig. 3-40
Assignment of functions that will be blocked together when blocking input 1 (MAIN: Blocking 1 EXT) is activated.	
MAIN: Fct.assign. block. 2	021 022 Fig. 3-40
Assignment of functions that will be blocked together when blocking input 2 (MAIN: Blocking 2 EXT) is activated.	
MAIN: Trip cmd.block. USER	021 012 Fig. 3-48
Blocking of the trip commands from the local control panel.	
MAIN: Fct.assig.trip cmd.1	021 001 Fig. 3-48
Assignment of the signals that trigger trip command 1.	
MAIN: Fct.assig.trip cmd.2	021 002 Fig. 3-48
Assignment of the signals that trigger trip command 2.	
MAIN: Min.dur. trip cmd. 1	021 003 Fig. 3-48
Setting for the minimum duration of trip command 1.	
MAIN: Min.dur. trip cmd. 2	021 004 Fig. 3-48
Setting for the minimum duration of trip command 2.	
MAIN: Latching trip cmd. 1	021 023 Fig. 3-48
Specification as to whether trip command 1 should latch.	
MAIN: Latching trip cmd. 2	021 024 Fig. 3-48
Specification as to whether trip command 2 should latch.	
MAIN: Close cmd.pulse time	015 067 Fig. 3-42
Setting for the duration of the close command.	
MAIN: Fct. assign. fault	021 031 Fig. 3-41
Selection of the signals whose appearance shall result in a 'Blocked/faulty' signal and in the activation of the LED indicator labeled 'OUT OF SERVICE' – in addition to the signals that always result in the above signal and indication. In both cases, the device is blocked.	

Parameter subset selection

PSS: Control via USER 003 100 Fig. 3-55

If parameter subset selection is to be handled from the integrated local control panel rather than via the binary signal inputs, choose the '*Yes*' setting.

PSS: Param.subs.sel. USER 003 060 Fig. 3-55

Selection of the parameter subset from the local control panel.

PSS: Keep time 003 063 Fig. 3-55

The setting of this timer stage is relevant only if parameter subset selection is carried out via the binary signal inputs. Any voltage-free pause that may occur during selection is bridged. If, after this time period has elapsed, no binary signal input has yet been set, then the parameter subset selected from the local control panel shall apply.

Self-monitoring

SFMON: Fct. assign. warning 021 030 Fig. 3-56

Selection of the signals whose appearance shall result in the signals 'Warning (LED)' and 'Warning (relay) and in the activation of the LED indicator labeled 'ALARM'. Signals caused by faulty hardware and leading to blocking of the device are not configurable. They always result in the above signals and indication.

Fault data acquisition

FT_DA: Line length 010 005 Fig. 3-78

This setting defines the distance in km that the fault locator interprets as 100 % when calculating the fault distance.

FT_DA: Line reactance 010 012 Fig. 3-78

This setting defines the reactance X that the fault locator interprets as 100 % when calculating the fault distance.

FT_DA: Angle kG 012 036 Fig. 3-75

Angle setting for the complex ground factor $\underline{k}_G$.

$$\underline{k}_G = \frac{\underline{Z}_0 - \underline{Z}_{pos}}{3 \cdot \underline{Z}_{pos}}$$

$\underline{Z}_0$: zero-sequence impedance
$\underline{Z}_{pos}$: positive-sequence impedance

$$k_G \text{ angle} = \arctan\frac{X_0 - X_{pos}}{R_0 - R_{pos}} - \arctan\frac{X_{pos}}{R_{pos}}$$

R_0: resistance component of zero-sequence impedance
R_{pos}: resistance component of positive-sequence impedance
X_0: reactance component of zero-sequence impedance
X_{pos}: reactance component of positive-sequence impedance

If the calculated value cannot be set exactly, then next smaller value should be set.

FT_DA: Abs. value kG 012 037 Fig. 3-75

Setting for the absolute value of the complex ground factor $\underline{k}_G$.

$$\underline{k}_G = \frac{\underline{Z}_0 - \underline{Z}_{pos}}{3 \cdot \underline{Z}_{pos}}$$

$\underline{Z}_0$: zero-sequence impedance
$\underline{Z}_{pos}$: positive-sequence impedance

$$\left|\underline{k}_G\right| = \frac{\sqrt{(X_0 - X_{pos})^2 + (R_0 - R_{pos})^2}}{3 \cdot \sqrt{R_{pos}^2 + X_{pos}^2}}$$

R_0: resistance component of zero-sequence impedance
R_{pos}: resistance component of positive-sequence impedance
X_0: reactance component of zero-sequence impedance
X_{pos}: reactance component of positive-sequence impedance

If the calculated value cannot be set exactly, then the next smaller value should be set.

FT_DA: Start data acquisit. 010 011 Fig. 3-74

This setting determines at what point during a fault the acquisition of fault data should take place.

FT_DA: Output fault locat. 010 032 Fig. 3-74

Setting for the conditions under which fault location output occurs.

Fault recording

FT_RC: Fct. assig. trigger 003 085 Fig. 3-80

This setting defines the signals that will trigger fault recording.

FT_RC: I> 017 065 Fig. 3-80

This setting defines the threshold value of the phase currents that will trigger fault recording and fault data acquisition.

FT_RC: Pre-fault time 003 078 Fig. 3-82

Setting for the time during which data will be recorded before the onset of a fault (pre-fault recording time).

FT_RC: Post-fault time 003 079 Fig. 3-82

Setting for the time during which data will be recorded after the end of a fault (post-fault recording time).

FT_RC: Max. recording time 003 075 Fig. 3-82

Setting for the maximum recording time per fault. This includes pre-fault and post-fault recording times.

7.1.3.2 General Functions

Main function

MAIN: Hold time dyn.param. 018 009	Fig. 3-38
Setting for the hold time of the "dynamic parameters". After switching to the "dynamic" thresholds, the latter will remain active in place of the "normal" thresholds during this period.	
MAIN: Syst.IN enabled USER 018 008	Fig. 3-37
Enable/disable the DTOC or IDMT residual current stages.	
MAIN: Block tim.st. IN,neg 017 015	Fig. 3-45
This setting defines whether a blocking of the residual current stages should take place for single-pole or multi-pole phase current startings.	
MAIN: Gen. starting mode 017 027	Fig. 3-46
This setting defines whether the triggering of the residual current stages I_N>, $I_{ref,N}$>, I_N>> or I_{ref}>>> as well as the negative-sequence current stage $I_{ref,neg}$> should result in the formation of the general starting signal. If the setting is *W/o start. IN, Ineg* then the associated time delays $t_{IN>}$, $t_{Iref,N>}$, $t_{IN>>}$, $t_{IN>>>}$, $t_{Iref,neg>}$ are automatically excluded from the formation of the trip command.	
MAIN: Op. mode rush restr. 017 097	
Setting the operating mode of the inrush stabilization function.	
MAIN: Rush I(2*fn)/I(fn) 017 098	
Setting for the operate value of inrush stabilization.	
MAIN: I> lift rush restr. 017 095	
Setting the current threshold for inactivation of inrush stabilization.	
MAIN: Suppress start. sig. 017 054	Fig. 3-45
Setting of the timer stage for the suppression of the phase-selective startings and of the residual and negative-sequence system starting.	
MAIN: tGS 017 005	Fig. 3-46
Setting for the time delay of the general starting signal.	

Definite-time overcurrent protection

DTOC: General enable USER 022 075	Fig. 3-83
Disabling or enabling the definite-time overcurrent protection function.	

Inverse-time overcurrent protection

IDMT: General enable USER 017 096	Fig. 3-94
Disabling or enabling the inverse-time overcurrent protection function.	

Short-circuit direction determination

SCDD: General enable USER 017 070	Fig. 3-106
Disabling and enabling short-circuit direction determination.	

Switch on to fault protection	SOTF: General enable USER	011 068	Fig. 3-116
	Disabling or enabling switch on to fault protection.		
	SOTF: Operating mode	011 061	Fig. 3-116
	The operating mode setting determines whether during elapsing of the timer stage a general starting state will lead to a trip (*Trip with starting*) or whether the measuring range of impedance zone 1 will be extended by the DIST: kze HSR zone extension factor (*Trip with overreach).*		
	SOTF: Manual close timer	011 060	Fig. 3-116
	Setting for the timer stage that will be started by a manual close.		
Protective signaling	PSIG: General enable USER	015 004	Fig. 3-117
	Disabling or enabling protective signaling.		
Auto-reclosing control	ARC: General enable USER	015 060	Fig. 3-123
	Disabling or enabling auto-reclosing control.		
	ARC: Sig.asg.trip t.GFDSS	015 105	Fig. 3-129
	Selection of the GFDSS starting to trigger the auto-reclosing control function.		
	ARC: Fct.assgn. tLOGIC	015 033	Fig. 3-133
	Function assignment to tLOGIC.		
Ground fault direction determination using steady-state values	GFDSS: General enable USER	016 060	Fig. 3-139
	Disabling or enabling ground fault direction determination by steady-state values.		
	GFDSS: Operating mode	016 090	Fig. 3-139
	This setting specifies whether steady-state power evaluation or steady-state current evaluation will be performed.		
	GFDSS: Op. mode GF pow./adm	016 063	Fig. 3-141, 3-147
	Setting for the operating mode of ground fault direction determination by steady-state power evaluation. The following settings are possible: □ *Cos φ circuit* for resonant-grounded systems □ *Sin φ circuit* for isolated-neutral systems.		
	GFDSS: Measuring direction	016 070	Fig. 3-141,3-147
	This setting defines the measuring direction for the 'forward' or 'backward' decision.		
	GFDSS: VNG>	016 062	Fig. 3-141,3-147
	Setting for the operate value of the neutral-displacement voltage.		
	GFDSS: tVNG>	016 061	Fig. 3-141,3-147
	Setting for the operate delay of the VNG> trigger.		
	GFDSS: f/fnom (pow.meas.)	016 091	Fig. 3-141,3-147
	Setting for the frequency of the measured variables evaluated in steady-state power evaluation.		

GFDSS: f/fnom (curr.meas.)	016 092 Fig. 3-145
Setting for the frequency of the measured variables evaluated in steady-state current evaluation.	
GFDSS: IN,act>/IN,reac> LS	016 064 Fig. 3-144
Setting for the threshold of the active or reactive power component of residual current that must be exceeded in order for the 'LS' (line side) direction decision to be enabled.	
GFDSS: Sector angle LS	016 065 Fig. 3-144
Setting of the sector angle for measurement in the line side direction. **Note:** This setting is only effective in the *cos φ circuit* operating mode.	
GFDSS: Operate delay LS	016 066 Fig. 3-144, 3-150
Setting for the operate delay of the direction decision in the forward direction.	
GFDSS: Release delay LS	016 072 Fig. 3-144,3-150
Setting for the release delay of the direction decision in the forward direction.	
GFDSS: IN,act>/IN,reac> BS	016 067 Fig. 3-144
Setting for the threshold of the active or reactive power component of residual current that must be exceeded in order for the 'BS' (busbar side) direction decision to be enabled.	
GFDSS: Sector angle BS	016 068 Fig. 3-144
Setting for the sector angle for measurement in the direction of the busbar side. **Note:** This setting is only effective in the *cos φ circuit* operating mode.	
GFDSS: Operate delay BS	016 069 Fig. 3-144,3-150
Setting for the operate delay of the direction decision in the backward direction.	
GFDSS: Release delay BS	016 073 Fig. 3-144,3-150
Setting for the release delay of the direction decision in the backward direction.	
GFDSS: IN>	016 093 Fig. 3-145
Setting for the operate value of the steady-state current evaluation.	
GFDSS: Operate delay IN	016 094 Fig. 3-145
Setting for the operate delay of steady-state current evaluation.	
GFDSS: Release delay IN	016 095 Fig. 3-145
Setting for the release delay of steady-state current evaluation.	

	GFDSS: G(N)> / B(N)> LS 016 111 Fig. 3-150 Setting for the threshold of the conductance or susceptance component of the residual current loop that must be exceeded in order for the 'LS' (line side) direction decision to be enabled.
	GFDSS: G(N)> / B(N)> BS 016 112 Fig. 3-150 Setting for the threshold of conductance or susceptance component of the residual current loop that must be exceeded in order for the 'BS' (busbar side) direction decision to be enabled.
	GFDSS: Y(N)> 016 113 Fig. 3-151 Setting for the operate value of the admittance for the non-directional ground fault determination in the admittance evaluation mode.
	GFDSS: Correction angle 016 110 Fig. 3-147 This setting is provided to compensate for phase-angle errors of the system transformers (in the admittance evaluation mode).
	GFDSS: Operate delay Y(N)> 016 114 Fig. 3-151 Setting for the operate delay of the admittance for the non-directional ground fault determination in the admittance evaluation mode.
	GFDSS: Release delay Y(N)> 016 115 Fig. 3-151 Setting for the release delay of the admittance for the non-directional ground fault determination in the admittance evaluation mode.
Motor protection	**MP: General enable USER** 017 059 Fig. 3-153 Enabling or disabling motor protection
Thermal overload protection	**THERM: General enable USER** 022 050 Fig. 3-163 Disabling or enabling thermal overload protection.
	THERM: Operating mode 022 063 Fig. 3-165 Setting the operating mode of thermal overload protection.
Unbalance protection	**I2>: General enable USER** 018 090 Fig. 3-167 Enabling or disabling unbalance protection.
Time-voltage protection	**V<>: General enable USER** 023 030 Fig. 3-169 Disabling or enabling time-voltage protection.
Over-/ underfrequency protection	**f<>: General enable USER** 023 031 Fig. 3-178 Disabling or enabling over-/underfrequency protection.
	f<>: Selection meas. volt 018 202 Fig. 3-179 Setting for the voltage that shall be used for frequency measurement.
	f<>: Evaluation time 018 201 Fig. 3-180 Setting for the evaluation time. The operate conditions must be met for the duration of the set evaluation time in order for a signal to be issued.
	f<>: Undervolt. block. V< 018 200 Fig. 3-180 Setting for the threshold of undervoltage blocking. If the voltage falls below this threshold, the over-/underfrequency protection function will be blocked.

Power directional protection

P<>: General enable USER	014 220 Fig. 3-183
Disabling or enabling the power directional protection function.	

Circuit breaker failure protection

CBF: General enable USER	022 080 Fig. 3-189
Disabling or enabling circuit breaker failure protection.	
CBF: tCBF	011 067 Fig. 3-189
Setting for the operate delay at the conclusion of which the 'Circuit breaker failure' signal is issued.	

Measuring-circuit monitoring

MCMON: General enable USER	014 001 Fig. 3-191
Disabling or enabling measuring-circuit monitoring.	
MCMON: Op. mode Idiff>	017 028 Fig. 3-191
Adaptation of measuring-circuit monitoring to the system current transformers.	
MCMON: Idiff>	017 024 Fig. 3-191
Setting for the operate value of measuring-circuit monitoring.	
MCMON: Op. mode Vmin< monit	018 079 Fig. 3-192
Selection of the monitoring mode in the voltage-measuring circuit.	
MCMON: Vmin<	017 022 Fig. 3-192
Operate value setting for the voltage trigger Vmin< of measuring circuit monitoring.	
MCMON: Operate delay	017 023 Fig. 3-191
Setting of the time delay for current and voltage monitoring.	
MCMON: Phase sequ. monitor.	018 019 Fig. 3-192
Enabling or disabling phase sequence monitoring.	

Limit value monitoring

LIMIT: General enable USER	014 010 Fig. 3-193
Disabling or enabling limit value monitoring.	
LIMIT: I>	014 004 Fig. 3-193
Setting for the operate value of the first overcurrent stage of limit value monitoring.	
LIMIT: I>>	014 020 Fig. 3-193
Setting for the operate value of the second overcurrent stage of limit value monitoring.	
LIMIT: tI>	014 031 Fig. 3-193
Setting for the operate delay of the first overcurrent stage of limit value monitoring.	
LIMIT: tI>>	014 032 Fig. 3-193
Setting for the operate delay of the second overcurrent stage of limit value monitoring.	

LIMIT: I< 014 021 Fig. 3-193

Setting for the operate value of the first undercurrent stage of limit value monitoring.

LIMIT: I<< 014 022 Fig. 3-193

Setting for the operate value of the second undercurrent stage of limit value monitoring.

LIMIT: tI< 014 033 Fig. 3-193

Setting for the operate delay of the first undercurrent stage of limit value monitoring.

LIMIT: tI<< 014 034 Fig. 3-193

Setting for the operate delay of the second undercurrent stage of limit value monitoring.

LIMIT: VPG> 014 023

Setting for the operate value of overvoltage stage VPG> of limit value monitoring.

LIMIT: VPG>> 014 024

Setting for the operate value of overvoltage stage VPG>> of limit value monitoring.

LIMIT: tVPG> 014 035

Setting for the operate delay of overvoltage stage VPG> of limit value monitoring.

LIMIT: tVPG>> 014 036

Setting for the operate delay of overvoltage stage VPG>> of limit value monitoring.

LIMIT: VPG< 014 025

Setting for the operate value of undervoltage stage VPG< of limit value monitoring.

LIMIT: VPG<< 014 026

Setting for the operate value of undervoltage stage VPG<< of limit value monitoring.

LIMIT: tVPG< 014 037

Setting for the operate delay of undervoltage stage VPG< of limit value monitoring.

LIMIT: tVPG<< 014 038

Setting for the operate delay of undervoltage stage VPG<< of limit value monitoring.

LIMIT: VPP> 014 027

Setting for the operate value of overvoltage stage VPP> of limit value monitoring.

LIMIT: VPP>> 014 028

Setting for the operate value of overvoltage stage VPP>> of limit value monitoring.

LIMIT: tVPP>	014 039	
Setting for the operate delay of overvoltage stage VPP> of limit value monitoring.		
LIMIT: tVPP>>	014 040	
Setting for the operate delay of overvoltage stage VPP>> of limit value monitoring.		
LIMIT: VPP<	014 029	
Setting for the operate value of undervoltage stage VPP< of limit value monitoring.		
LIMIT: VPP<<	014 030	
Setting for the operate value of undervoltage stage VPP<< of limit value monitoring.		
LIMIT: tVPP<	014 041	
Setting for the operate delay of undervoltage stage VPP< of limit value monitoring.		
LIMIT: tVPP<<	014 042	
Setting for the operate delay of undervoltage stage VPP<< of limit value monitoring.		
LIMIT: VNG>	014 043	Fig. 3-195
Setting for the operate value of overvoltage stage VNG> of limit value monitoring.		
LIMIT: VNG>>	014 044	Fig. 3-195
Setting for the operate value of overvoltage stage VNG>> of limit value monitoring.		
LIMIT: tVNG>	014 045	Fig. 3-195
Setting for the operate delay of overvoltage stage VNG> of limit value monitoring.		
LIMIT: tVNG>>	014 046	Fig. 3-195
Setting for the operate delay of overvoltage stage VNG>> of limit value monitoring.		

Logic

LOGIC: General enable USER	031 099	Fig. 3-197
Disabling or enabling the logic function.		
LOGIC: Set 1 USER	034 030	Fig. 3-196, 3-203
LOGIC: Set 2 USER	034 031	
LOGIC: Set 3 USER	034 032	
LOGIC: Set 4 USER	034 033	
LOGIC: Set 5 USER	034 034	
LOGIC: Set 6 USER	034 035	
LOGIC: Set 7 USER	034 036	
LOGIC: Set 8 USER	034 037	Fig. 3-203
These settings define the static input conditions for the logic function.		

LOGIC: Fct.assignm. outp. 1	030 000	Fig. 3-133,3-197
LOGIC: Fct.assignm. outp. 2	030 004	Fig. 3-133
LOGIC: Fct.assignm. outp. 3	030 008	
LOGIC: Fct.assignm. outp. 4	030 012	
LOGIC: Fct.assignm. outp. 5	030 016	
LOGIC: Fct.assignm. outp. 6	030 020	
LOGIC: Fct.assignm. outp. 7	030 024	
LOGIC: Fct.assignm. outp. 8	030 028	
LOGIC: Fct.assignm. outp. 9	030 032	
LOGIC: Fct.assignm. outp.10	030 036	
LOGIC: Fct.assignm. outp.11	030 040	
LOGIC: Fct.assignm. outp.12	030 044	
LOGIC: Fct.assignm. outp.13	030 048	
LOGIC: Fct.assignm. outp.14	030 052	
LOGIC: Fct.assignm. outp.15	030 056	
LOGIC: Fct.assignm. outp.16	030 060	
LOGIC: Fct.assignm. outp.17	030 064	
LOGIC: Fct.assignm. outp.18	030 068	
LOGIC: Fct.assignm. outp.19	030 072	
LOGIC: Fct.assignm. outp.20	030 076	
LOGIC: Fct.assignm. outp.21	030 080	
LOGIC: Fct.assignm. outp.22	030 084	
LOGIC: Fct.assignm. outp.23	030 088	
LOGIC: Fct.assignm. outp.24	030 092	
LOGIC: Fct.assignm. outp.25	030 096	
LOGIC: Fct.assignm. outp.26	031 000	
LOGIC: Fct.assignm. outp.27	031 004	
LOGIC: Fct.assignm. outp.28	031 008	
LOGIC: Fct.assignm. outp.29	031 012	
LOGIC: Fct.assignm. outp.30	031 016	
LOGIC: Fct.assignm. outp.31	031 020	
LOGIC: Fct.assignm. outp.32	031 024	

These settings assign functions to the outputs.

LOGIC: Op. mode t output 1	030 001	Fig. 3-133,3-197
LOGIC: Op. mode t output 2	030 005	Fig. 3-133
LOGIC: Op. mode t output 3	030 009	
LOGIC: Op. mode t output 4	030 013	
LOGIC: Op. mode t output 5	030 017	
LOGIC: Op. mode t output 6	030 021	
LOGIC: Op. mode t output 7	030 025	
LOGIC: Op. mode t output 8	030 029	
LOGIC: Op. mode t output 9	030 033	
LOGIC: Op. mode t output 10	030 037	
LOGIC: Op. mode t output 11	030 041	
LOGIC: Op. mode t output 12	030 045	
LOGIC: Op. mode t output 13	030 049	
LOGIC: Op. mode t output 14	030 053	
LOGIC: Op. mode t output 15	030 057	
LOGIC: Op. mode t output 16	030 061	
LOGIC: Op. mode t output 17	030 065	
LOGIC: Op. mode t output 18	030 069	
LOGIC: Op. mode t output 19	030 073	
LOGIC: Op. mode t output 20	030 077	
LOGIC: Op. mode t output 21	030 081	
LOGIC: Op. mode t output 22	030 085	
LOGIC: Op. mode t output 23	030 089	
LOGIC: Op. mode t output 24	030 093	
LOGIC: Op. mode t output 25	030 097	
LOGIC: Op. mode t output 26	031 001	
LOGIC: Op. mode t output 27	031 005	
LOGIC: Op. mode t output 28	031 009	
LOGIC: Op. mode t output 29	031 013	
LOGIC: Op. mode t output 30	031 017	
LOGIC: Op. mode t output 31	031 021	
LOGIC: Op. mode t output 32	031 025	

These settings define the operating modes for the output timer stages.

LOGIC: Time t1 output 1	030 002	Fig. 3-197
LOGIC: Time t1 output 2	030 006	
LOGIC: Time t1 output 3	030 010	
LOGIC: Time t1 output 4	030 014	
LOGIC: Time t1 output 5	030 018	
LOGIC: Time t1 output 6	030 022	
LOGIC: Time t1 output 7	030 026	
LOGIC: Time t1 output 8	030 030	
LOGIC: Time t1 output 9	030 034	
LOGIC: Time t1 output 10	030 038	
LOGIC: Time t1 output 11	030 042	
LOGIC: Time t1 output 12	030 046	
LOGIC: Time t1 output 13	030 050	
LOGIC: Time t1 output 14	030 054	
LOGIC: Time t1 output 15	030 058	
LOGIC: Time t1 output 16	030 062	
LOGIC: Time t1 output 17	030 066	
LOGIC: Time t1 output 18	030 070	
LOGIC: Time t1 output 19	030 074	
LOGIC: Time t1 output 20	030 078	
LOGIC: Time t1 output 21	030 082	
LOGIC: Time t1 output 22	030 086	
LOGIC: Time t1 output 23	030 090	
LOGIC: Time t1 output 24	030 094	
LOGIC: Time t1 output 25	030 098	
LOGIC: Time t1 output 26	031 002	
LOGIC: Time t1 output 27	031 006	
LOGIC: Time t1 output 28	031 010	
LOGIC: Time t1 output 29	031 014	
LOGIC: Time t1 output 30	031 018	
LOGIC: Time t1 output 31	031 022	
LOGIC: Time t1 output 32	031 026	

Settings for timer stage t1 of the respective outputs.

LOGIC: Time t2 output 1	030 003	Fig. 3-197
LOGIC: Time t2 output 2	030 007	
LOGIC: Time t2 output 3	030 011	
LOGIC: Time t2 output 4	030 015	
LOGIC: Time t2 output 5	030 019	
LOGIC: Time t2 output 6	030 023	
LOGIC: Time t2 output 7	030 027	
LOGIC: Time t2 output 8	030 031	
LOGIC: Time t2 output 9	030 035	
LOGIC: Time t2 output 10	030 039	
LOGIC: Time t2 output 11	030 043	
LOGIC: Time t2 output 12	030 047	
LOGIC: Time t2 output 13	030 051	
LOGIC: Time t2 output 14	030 055	
LOGIC: Time t2 output 15	030 059	
LOGIC: Time t2 output 16	030 063	
LOGIC: Time t2 output 17	030 067	
LOGIC: Time t2 output 18	030 071	
LOGIC: Time t2 output 19	030 075	
LOGIC: Time t2 output 20	030 079	
LOGIC: Time t2 output 21	030 083	
LOGIC: Time t2 output 22	030 087	
LOGIC: Time t2 output 23	030 091	
LOGIC: Time t2 output 24	030 095	
LOGIC: Time t2 output 25	030 099	
LOGIC: Time t2 output 26	031 003	
LOGIC: Time t2 output 27	031 007	
LOGIC: Time t2 output 28	031 011	
LOGIC: Time t2 output 29	031 015	
LOGIC: Time t2 output 30	031 019	
LOGIC: Time t2 output 31	031 023	
LOGIC: Time t2 output 32	031 027	

Settings for timer stage t2 of the respective outputs.

Note: This setting has no effect in the ‘minimum time’ operating mode.

LOGIC: Sig.assig. outp. 1	044 000	Fig. 3-203
LOGIC: Sig.assig. outp. 2	044 002	
LOGIC: Sig.assig. outp. 3	044 004	
LOGIC: Sig.assig. outp. 4	044 006	
LOGIC: Sig.assig. outp. 5	044 008	
LOGIC: Sig.assig. outp. 6	044 010	
LOGIC: Sig.assig. outp. 7	044 012	
LOGIC: Sig.assig. outp. 8	044 014	
LOGIC: Sig.assig. outp. 9	044 016	
LOGIC: Sig.assig. outp. 10	044 018	
LOGIC: Sig.assig. outp. 11	044 020	
LOGIC: Sig.assig. outp. 12	044 022	
LOGIC: Sig.assig. outp. 13	044 024	
LOGIC: Sig.assig. outp. 14	044 026	
LOGIC: Sig.assig. outp. 15	044 028	
LOGIC: Sig.assig. outp. 16	044 030	
LOGIC: Sig.assig. outp. 17	044 032	
LOGIC: Sig.assig. outp. 18	044 034	
LOGIC: Sig.assig. outp. 19	044 036	
LOGIC: Sig.assig. outp. 20	044 038	
LOGIC: Sig.assig. outp. 21	044 040	
LOGIC: Sig.assig. outp. 22	044 042	
LOGIC: Sig.assig. outp. 23	044 044	
LOGIC: Sig.assig. outp. 24	044 046	
LOGIC: Sig.assig. outp. 25	044 048	
LOGIC: Sig.assig. outp. 26	044 050	
LOGIC: Sig.assig. outp. 27	044 052	
LOGIC: Sig.assig. outp. 28	044 054	
LOGIC: Sig.assig. outp. 29	044 056	
LOGIC: Sig.assig. outp. 30	044 058	
LOGIC: Sig.assig. outp. 31	044 060	
LOGIC: Sig.assig. outp. 32	044 062	

These settings assign the function of a binary input signal to the output of the logic equation.

Fig. 3-203

LOGIC: Sig.assig.outp. 1(t)	044 001
LOGIC: Sig.assig.outp. 2(t)	044 003
LOGIC: Sig.assig.outp. 3(t)	044 005
LOGIC: Sig.assig.outp. 4(t)	044 007
LOGIC: Sig.assig.outp. 5(t)	044 009
LOGIC: Sig.assig.outp. 6(t)	044 011
LOGIC: Sig.assig.outp. 7(t)	044 013
LOGIC: Sig.assig.outp. 8(t)	044 015
LOGIC: Sig.assig.outp. 9(t)	044 017
LOGIC: Sig.assig.outp.10(t)	044 019
LOGIC: Sig.assig.outp.11(t)	044 021
LOGIC: Sig.assig.outp.12(t)	044 023
LOGIC: Sig.assig.outp.13(t)	044 025
LOGIC: Sig.assig.outp.14(t)	044 027
LOGIC: Sig.assig.outp.15(t)	044 029
LOGIC: Sig.assig.outp.16(t)	044 031
LOGIC: Sig.assig.outp.17(t)	044 033
LOGIC: Sig.assig.outp.18(t)	044 035
LOGIC: Sig.assig.outp.19(t)	044 037
LOGIC: Sig.assig.outp.20(t)	044 039
LOGIC: Sig.assig.outp.21(t)	044 041
LOGIC: Sig.assig.outp.22(t)	044 043
LOGIC: Sig.assig.outp.23(t)	044 045
LOGIC: Sig.assig.outp.24(t)	044 047
LOGIC: Sig.assig.outp.25(t)	044 049
LOGIC: Sig.assig.outp.26(t)	044 051
LOGIC: Sig.assig.outp.27(t)	044 053
LOGIC: Sig.assig.outp.28(t)	044 055
LOGIC: Sig.assig.outp.29(t)	044 057
LOGIC: Sig.assig.outp.30(t)	044 059
LOGIC: Sig.assig.outp.31(t)	044 061
LOGIC: Sig.assig.outp.32(t)	044 063

These settings assign the function of a binary input signal to the output of the logic equation.

7.1.1.3 Parameter Subsets

Definite-time overcurrent protection

DTOC: Enable PSx — 072 098 073 098 074 098 075 098 — Fig. 3-83

This setting defines the parameter subset in which definite-time overcurrent protection is enabled.

DTOC: I> PSx — 017 000 073 007 074 007 075 007 — Fig. 3-84

Setting for the operate value of the first overcurrent stage (phase current stage).

Caution! The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').

DTOC: I> dynamic PSx — 017 080 073 032 074 032 075 032 — Fig. 3-84

Setting for the operate value of the first overcurrent stage in dynamic mode (phase current stage). This operate value is effective only while the timer stage MAIN: Hold-time dyn. param. is elapsing.

Caution! The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').

DTOC: I>> PSx — 017 001 073 008 074 008 075 008 — Fig. 3-84

Setting for the operate value of the second overcurrent stage (phase current stage).

Caution! The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').

DTOC: I>> dynamic PSx — 017 084 073 033 074 033 075 033 — Fig. 3-84

Setting for the operate value of the second overcurrent stage in dynamic mode (phase current stage). This operate value is effective only while the timer stage MAIN: Hold-time dyn. param. is elapsing.

Caution! The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').

DTOC: I>>> PSx — 017 002 073 009 074 009 075 009 — Fig. 3-84

Setting for the operate value of the third overcurrent stage (phase current stage).

Caution! The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').

DTOC: I>>> dynamic PSx — 017 085 073 034 074 034 075 034 — Fig. 3-84

Setting for the operate value of the third overcurrent stage in dynamic mode (phase current stage). This operate value is effective only while the timer stage MAIN: Hold-time dyn. param. is elapsing.

Caution! The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').

DTOC: tI> PSx — 017 004 073 019 074 019 075 019 — Fig. 3-84

Setting for the operate delay of the first overcurrent stage.

DTOC: tI>> PSx — 017 006 073 020 074 020 075 020 — Fig. 3-84

Setting for the operate delay of the second overcurrent stage.