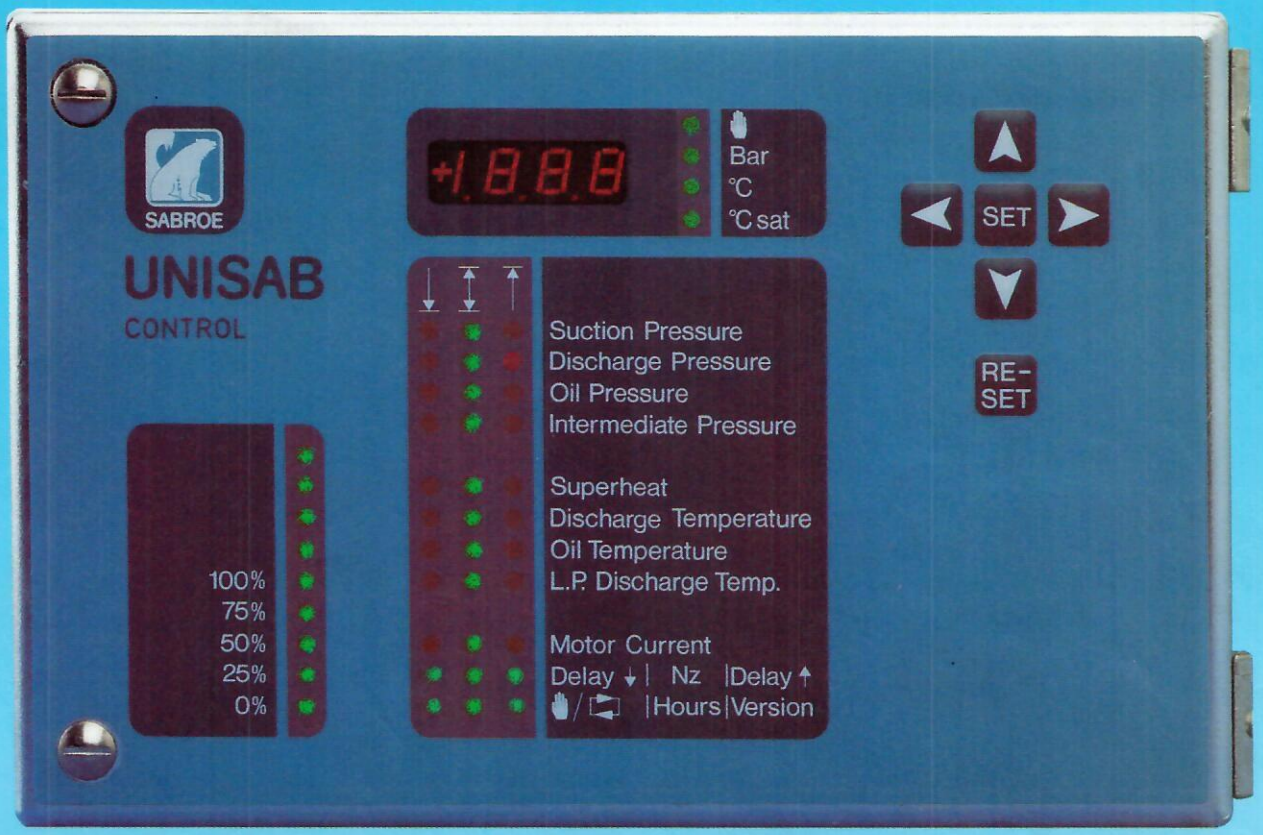
Instruction manual
UNISAB Control



For reciprocating compressors

CMO/TCMO 2 – SMC/TSMC 100 – SMC/TSMC 180

0171-751

Compressor type: CMO 26 **Shop no.:** 91o76 **Refrigerant:** R 22

Preface

This instruction manual describes the UNISAB control system in detail, including function, use, maintenance, service and trouble shooting.

Please read this manual carefully to ensure that you are thoroughly aquainted with the UNISAB control system, and know how to operate it correctly. Damage which occurs as a result of incorrect operation is not covered by SABROE's guarantee.

Important

If it proves necessary to service the UNISAB control system, the power supply to the compressor motor **must** be switched off at the main switch to prevent the compressor from being started accidentally.

Warning

The UNISAB Control box contains live micro-electronic parts which makes it absolutely necessary that you comply with the safety regulations prescribed on site. Failure to do so may cause damage to equipment and affect personal safety.

Only authorised personnel are permitted to service the UNISAB control.

SABROE REFRIGERATION A/S
PRODUCT DIVISION
P.O. Box 1810, DK–8270 Højbjerg
Chr. X's Vej 201, Århus, Denmark

SABROE

Phone: +45 6 27 12 66
Telefax: +45 6 27 44 08
Telex: 6 87 40

Table of contents

Description of UNISAB Control

The UNISAB control system for reciprocating compressors, monitors and protects the compressor, ensuring that it operates within the predetermined operating limits.

Pressure transducers, fitted on the UNISAB control and temperature sensors, fitted on the compressor, are connected to the UNISAB, which, in turn, is connected to solenoid valves on the compressor – a system which enables the UNISAB to regulate compressor capacity to suit plant requirements.

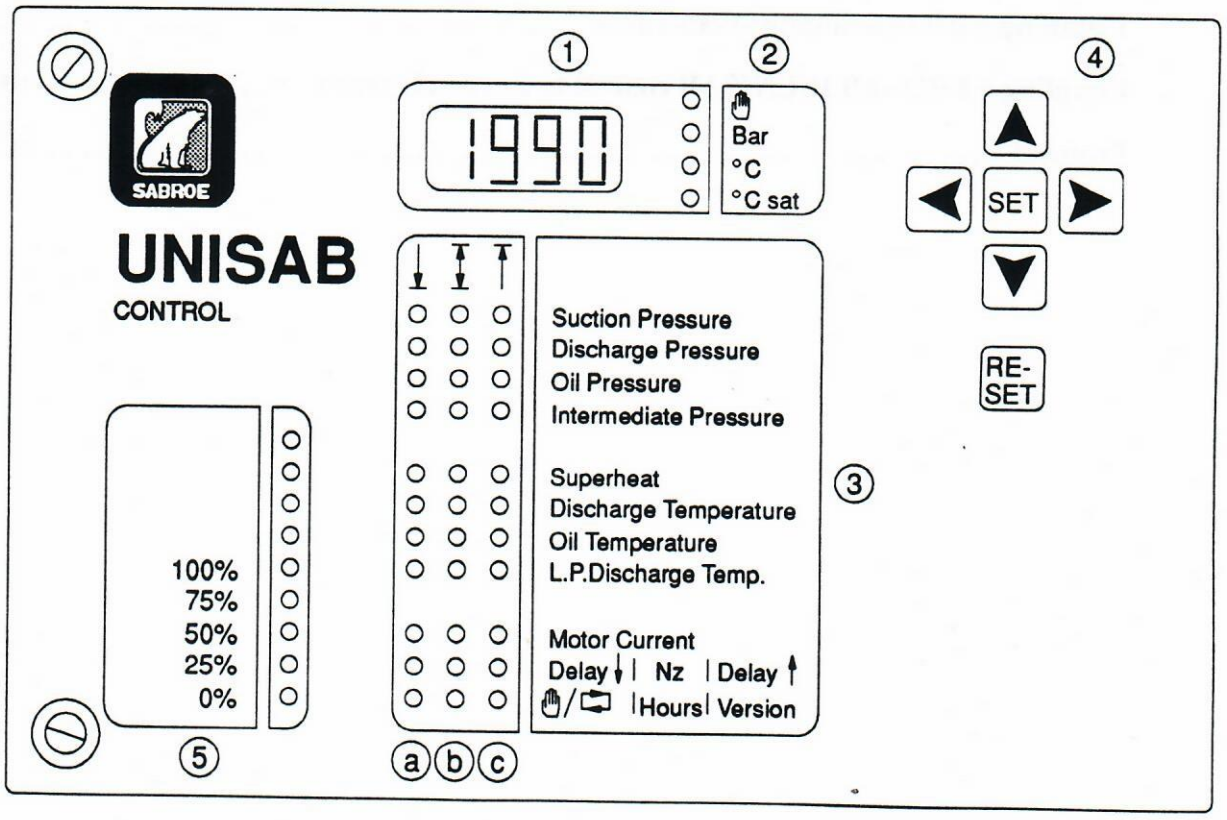
The UNISAB control also has various limitation functions. Furthermore, it can change from automatic to manual capacity regulation as required.

Reciprocating compressors fitted with UNISAB control can be inter-connected to form an integrated system which ensures that the refrigeration plant operates optimally. Screw compressors can also be connected to this system, provided they are fitted with PROSAB II – a computerized control system specially designed for screw compressors.

The simple front panel (illustrated below) makes the UNISAB control very easy to operate. The following description refers to the position numbers used on the drawing.

Various values have been set by our factory so that the UNISAB control is ready to operate when it is delivered. These values can be changed according to the actual operating conditions.

Note:
The UNISAB control **always** remembers the values set by the factory – even if the power supply is cut off.



Pos. 1 shows a four-digit display.

Pos. 2 – LEDs are used to indicate the dimension of the value in the display and whether the compressor is regulated manually ✋ or automatically 🖴

- Pressure is shown in Bar or PSI.
- Temperature is shown in °C or °F.

  If you require the refrigerant pressure for saturated vapour shown in °C or °F, press the **SET** key and the LED for °C sat or °F sat will light up.

Pos. 3 indicates, by means of LEDs, which pressure or temperature reading is displayed. Operating values and alarm limits can be displayed, depending on which light diode is lit. The following temperature and pressure values can be displayed:

Column a: Lowest alarm limit
Column b: Actual operating values
Column c: Highest alarm limit

Pos 4 – The keyboard is used to:

- select data points to be displayed
- change displayed value
- select unit for pressures
- increase/decrease capacity when in manual operation.

Pos. 5 shows the number of compressor cylinders in operation.

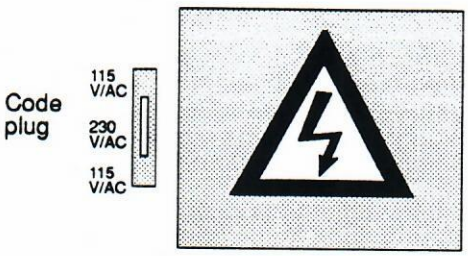
Operating the UNISAB Control

Start-up

- UNISAB-control should be connected as shown in the wiring diagram.
- Check to ensure that the UNISAB control is correctly coded for the voltage available.

The coded voltage is stated on the side of the code plug, as shown in the example below:

The code plug is placed beside the transformer as illustrated.



315 mA/250 V/AC fuse
630 mA/110 V/AC fuse

The UNISAB control will be ready to operate approx. 5 seconds after power is supplied.

Note:
Even if there is a power cut the UNISAB control will **always** remember the coded set values, regardless of how long the power supply is off.

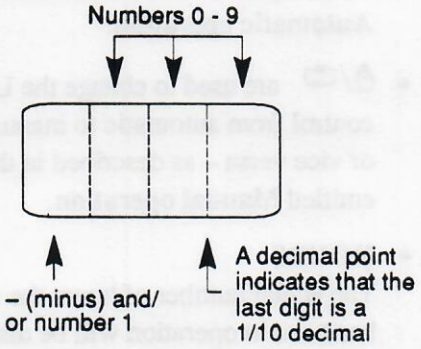
Furthermore, please note the following:

- When the UNISAB control is supplied alarm limits will have been coded in by our factory, as stated in the table in the section entitled **Factory setting of alarm limits.** The UNISAB control is ready for operation.
- When power has been connected the UNISAB control will be set to **manual operation.**
- You can change to **automatic operation** by following the instructions given in this manual – please refer to the section entitled **Automatic operation.**
- If you wish to inter-connect several compressors (each fitted with UNISAB control) please refer to the section entitled **MULTISAB – sequential regulation.**
- If the power is connected whilst UNISAB is set to **automatic operation,** the display will flash for 60 seconds. During this period communication between the units will be reestablished. Capacity regulation will be disabled. This applies even if only one UNISAB control is installed.

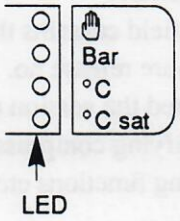
  When the display light stops flashing automatic operation will be resumed.

Operator panel

Pos. 1: Display



Pos. 2: Unit indicator



The LEDs indicate whether the compressor is regulated manually or automatically and the dimension of the value displayed.

- If the light in the LED alongside ✋ lights up, the UNISAB control is set to manual operation.
- If there is no light, the UNISAB control is set to automatic operation.
- A light in the LED alongside Bar or °C indicates that the display is either Bar or °C respectively.

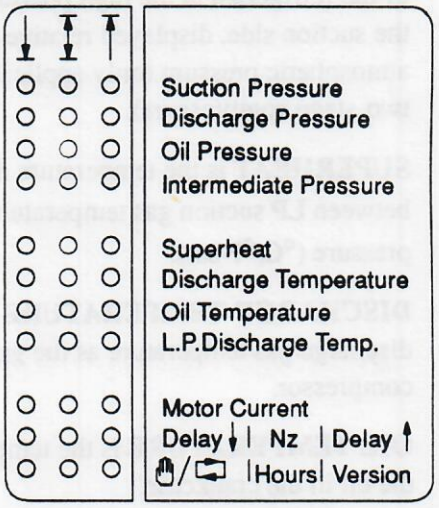
UNISAB can only display either Bar and °C, or PSI and °F for the relevant refrigerant. Your selection, which is indicated by a **version no.**, is coded in by SABROE. Only SABROE can change this code in favour of another version no.

°C sat and °F sat indicate that pressures for suction pressure, discharge pressure and intermediate pressure are shown in the corresponding temperatures for saturated vapour.

To change from Bar (PSI) to °C (°F) sat and vice versa depress the SET key momentarily.

Bar and PSI values are displayed relative to atmospheric pressure.

Pos. 3: LEDs for value points



The LED with steady light indicates which value is shown in the display. Obviously only one LED can be lit at any given time.

Except for the last three rows, the three columns in the LED field marked ↕ , ↓ and ↑ function as follows:

↕ indicates the actual measured value for the measured point shown in the display.

↓ indicates that it is the lowest alarm limit for the measured point shown in the display.

↑ indicates that it is the highest alarm limit for the measured point shown in the display.

The keyboard must be used to move the light diode – please refer to pos. 4 **Keyboard.**

The values should be interpreted as follows:

SUCTION PRESSURE is the pressure of the refrigerant on the suction side of the compressor, displayed relative to atmospheric pressure.

DISCHARGE PRESSURE is the pressure of the refrigerant on the pressure side, displayed relative to atmospheric pressure.

OIL PRESSURE is the pressure in the compressor's oil system.

INTERMEDIATE PRESSURE is the pressure of the refrigerant at the high pressure stage on the suction side, displayed relative to atmospheric pressure (only applicable to two-stage compressors).

SUPERHEAT is the temperature difference between LP suction gas temperature (°C/°F) and pressure (°C/°F sat).

DISCHARGE TEMPERATURE is the discharge gas temperature as the gas leaves the compressor.

OIL TEMPERATURE is the temperature of the oil in the crankcase.

LP DISCHARGE TEMPERATURE (only applicable to TSMC compressors) is the temperature of the refrigerant gas when it is discharged from the low-stage.

The values at the bottom of the LED field should be interpreted as follows:

- **Motor current** is a limiting function which signals when the motor is overloaded and reduces the compressor capacity to counteract the overloading. Please refer to the section entitled **Measuring the motor current.**
- Delay ↓ | Nz | Delay ↑ is used for regulating the compressor capacity.

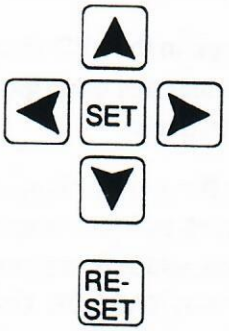
  Delay ↓ and Delay ↑ are time delays in the regulating sequence. Nz is the neutral zone. Please refer to the section entitled **Automatic operation.**
- ✋/🖵 are used to change the UNISAB control from automatic to manual operation or vice versa – as described in the section entitled **Manual operation.**
- **HOURS**
  The actual number of hours the compressor has been in operation will be displayed.

  Note: the value displayed must be multiplied by 10. The UNISAB control reverts to 0 once 19990 hours have been exceeded.
- **VERSION**
  This field contains the version no. and the software release no. When the field is selected the version no. is displayed, identifying compressor type, refrigerant, cooling functions etc.

  If SET is pressed momentarily the software release no. is displayed.

  Important
  If you need to contact SABROE, please remember to state the version no. and the software release no. of the UNISAB control in question.

4. Keyboard



The six keys are used to select values and to change parameters. They are also used to acknowledge alarms when alarm limits are exceeded.

When the system is set to **Manual operation**, the keys are used to regulate compressor capacity.

The keys are used as follows:

◀ ▶ are used to move from one column to another in the light diode field 3.

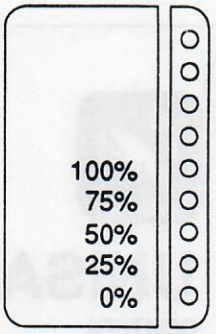
▲ ▼ are used to move up or down from one value to another in Pos. 3. They are also used to change parameters, as described in **Changing parameters.**

SET by depressing this key momentarily you can switch from Bar (PSI) to °C sat (°F sat) as described in pos. 2.

The key is also used to enter input so that parameters can be changed, as described in **Changing parameters.**

RE-SET is used to acknowledge alarms.

Pos. 5 LED field for compressor capacity



This field indicates the compressor's current capacity expressed as a percentage, which corresponds to the number of cylinders in operation.

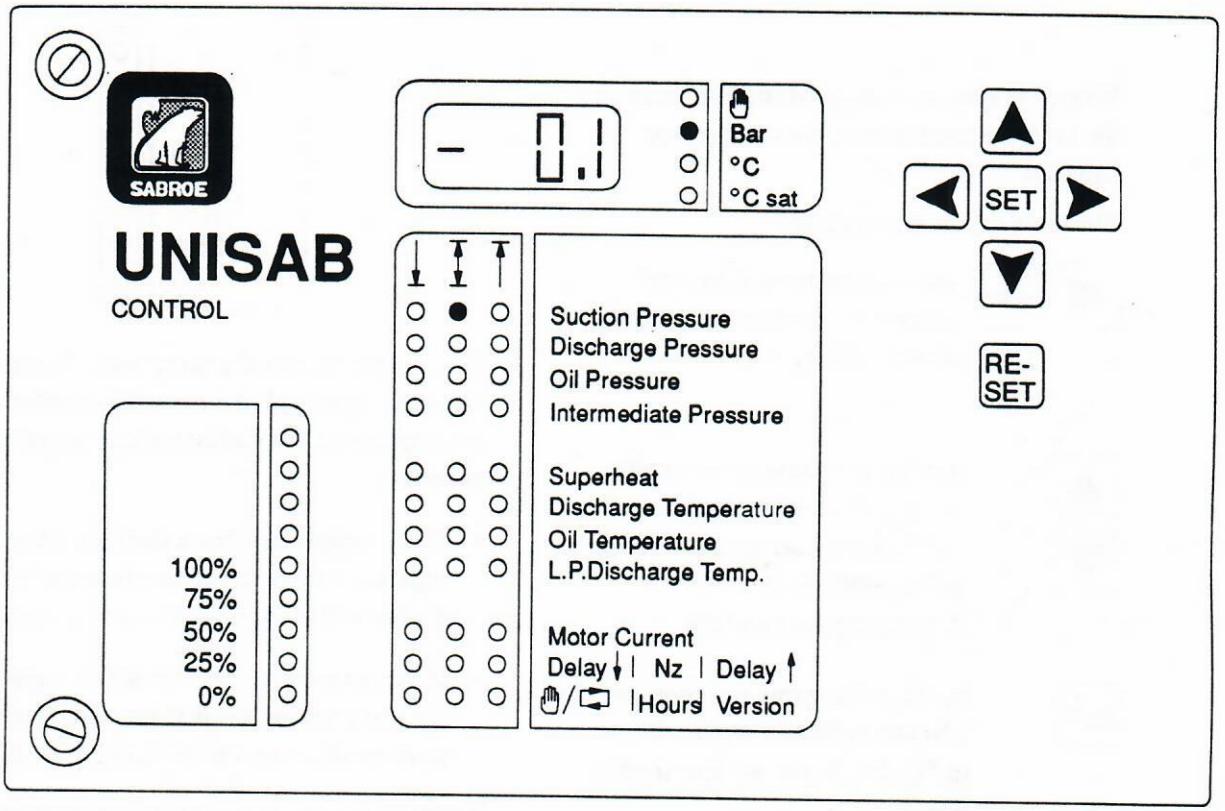
- If the compressor has a standard capacity regulation system, the two bottom light diodes will always light at the same time.
- If the compressor can run at **0%** capacity (i.e. the compressor is fitted with special equipment), only the 0% LED may light up.

If applicable (see compressor specification), the the top LED indicates the state of the cooling funcion (light = oil cooling active).

If applicable (see compressor specification), the second LED from the top indicates the state of the liquid injection function. (only applicable to two-stage compressors)

Basic operation

UNISAB control is easy to operate, as the following example clearly shows.



In the sketch above, the steady light in the middle column ↕ of the top row, indicates that the ready applies to measured suction pressure.

The light diode for **Bar** is lit and the display shows -0.1. **This means that the Suction Pressure is -0.1 Bar.**

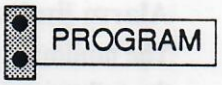
- By depressing the **SET** key momentarily, the light in the top panel will move from Bar to °C Sat LED. The display will then show the temperature which corresponds to the pressure for the refrigerant used.
- If the ◀ key is then pressed, the display will show the alarm limit for low suction pressure (column ↓).
- If you then press the ▼ key and then ▶ twice, the display will show the alarm limit for high discharge pressure (column ↑).

Changing parameters

Some of the values can be changed. These values are called parameters. All parameters are preset by SABROE before the UNISAB control leaves the factory. If you wish to change one or more of these parameters you must first connect a jumper in the UNISAB control.

Open the cover. Inside you will see two prongs in the area marked **PROGRAM**. Interconnect these by means of the jumper, as shown in drawing **b**.

a. Jumper in disconnected position.



b. Jumper in connected position.

You will now be able to change the parameters in the UNISAB control.

♣ For example, if you wish to change the upper alarm limit for oil temperature (column ↑) press the directional keys until the relevant LED lights up.

- Press the [SET] key and hold it down for at least 1.5 seconds or until the digit to the far right of the display begins to flash.
- Pressing the [▲] key increases the value of the flashing digit.
- Likewise, pressing the [▼] key reduces the value of the flashing digit.
- Then press the [◀] key to move to the next digit. When this flashes press either [▲] or [▼] to set the value.
- When the parameter is coded in, depress the **SET** key momentarily to enter the value into the UNISAB control.
- If you want to alter other parameters just repeat the above procedure from ♣.

Note:
Suction pressure, discharge pressure and intermediate pressure can be changed using either BAR or °C sat (PSI or °F sat).

- If you press the **SET** key after point ♣ the display will change from Bar to °C sat.
- Then follow the rest of the procedure as described.

Important:
Once you have changed the alarm limit, please remember to set the jumper in the **disconnected position**, as shown in fig. **a** in the previous drawing. If you don't remember to do this you may change the alarm limits without meaning to do so.

Make sure the jumper is firmly in place.

Alarm/warning functions

Alarms

When an alarm limit is exceeded the compressor stops. The relevant LED will flash quickly and the alarm relay will change position.

The cause of the excessive temperature/pressure must be corrected and the value brought within the alarm limit before the alarm can be cancelled.

The compressor can now restart in two different ways – some of the alarms by **automatic reset** and some by **manual reset**.

- Press RESET to reset "manual alarms" so that the UNISAB control is ready to restart.

In the following table manual reset is indicated by **M**, and automatic reset by **A**.

	Low↓	High ↑
Suction pressure	A	
Discharge pressure	A	M
Oil pressure	M	M
Intermediate pressure	A	M
Superheat	M	M
Discharge temp.	M	M
Oil temperature	M	M
LP discharge temp.	M	M
Thermistor		M

- With automatic reset the compressor can restart when the actual measuring value is again within the warning limit (i.e. it is not necessary to press the RESET key).
- With manual reset the compressor can only start when the reason for stopping has been rectified and the actual measuring value is once again within the warning limit and the RESET key has been pressed.

Alarm relay

The electric connection to the thermal overload relay must be passed through UNISAB control's alarm relay as shown on the wiring diagram.

Note:

This alarm relay is activated during normal operation.

Alarm limits:

The minimum and maximum values shown in the following table apply to both low and high alarm limits.

	Low ↓		High ↑	
	Bar	Psi	Bar	Psi
Suction pressure	-1	-14	7	100
Discharge pressure	-1	-14	25	360
Oil pressure	3.5	50	25	360
Intermediate pressure	-1	-14	25	360

	°C	°F	°C	°F
Superheat	0	0	80	145
Discharge temp.	-20	-4	150	300
Oil temperature	0	32	110	230
LP discharge temp.	-20	-4	150	300

Note:

- The high limit ↑ for suction pressure is the set point for regulation and **not** an alarm limit. Please refer to the section entitled *Automatic operation.*
- If the minimum alarm limit for superheat ↓ is set at 0, alarms and warnings will not be given when the superheat reaches 0°C (°F) and the compressor will **not** stop. A value of 0 may be relevant on an R717 pump circulation plant, where the superheat can in practice be 0, even in a dry suction gas pipe to the compressor.

Important:
If possible the superheat alarm should be allowed to function, as it protects the compressor from liquid hammer during normal operation.

However, it doesn't prevent liquid from flowing with the suction gas in the event of a plant error. This will, of course, cause liquid hammer in the compressor and obviously the fault must be found and rectified.

Factory settings for alarm limits:

The following table indicates the alarm limits which are set by SABROE before the unit is dispatched.

	Low ↓			High ↑		
	Factory		Actual	Factory		Actual
Suction pressure	0 Bar	0 PSI		–	–	–
Discharge pressure	-1 Bar	-14 PSI		18 Bar	260 PSI	
Oil pressure	3.5 Bar	50 PSI		8 Bar	115 PSI	
Intermediate pressure	1 Bar	14 PSI		25 Bar	360 PSI	
Superheat	2° C	4° F		80° C	145° F	
Discharge temperature	0° C	32° F		120° C	250° F	
Oil temperature	30° C	85° F		80° C	175° F	
LP discharge temperature	0° C	32° F		100° C	210° F	

The two columns marked **Actual** are provided so that you can note the values you have set for alarm limits by following the steps given in **Changing alarm limits.**

Note:

- At the low limit, the oil pressure alarm will be delayed 60 seconds during start-up and during operation.
- At the low limit, the superheat alarm is delayed 15 seconds during start-up.
- At the high limit, the superheat alarm is delayed 300 seconds during start-up.
- At the low limit, the oil temperature alarm is delayed 300 seconds during start-up.

UNISAB control has an alarm relay which changes position when an alarm situation occurs in the compressor. This relay can be used to provide a remote alarm (flashing light or warning bell). Please note the connection on the wiring diagram.

Reverting to factory settings for alarm limits

The **configuration** function (see relevant section) allows you to revert to the alarm limits set by SABROE after you have coded new limits in.

Warnings:

The UNISAB control also has warning limits which cannot be changed. However all warning limits are linked to the alarm limits, so that if you change the alarm limit the warning limit will follow suit at a predetermined distance coded in by SABROE.

When a warning limit is exceeded, the relevant LED will flash slowly.

Warning limits:

The following table states the distance between warnings and alarms :

	Low ↓		High ↑	
Suction pressure	5°C sat	9°F sat		
Discharge pressure	1 Bar	14 PSI	2 Bar	29 PSI
Oil pressure	0,3 Bar	4,5 PSI	2 Bar	29 PSI
Intermediate pressure	5°C sat	9°F sat	5 °C sat	9°F sat
Superheat	1°C	2°F	5°C	9°F
Discharge temperature	5°C	9°F	5°C	9°F
Oil temperature	5°C	9°F	5°C	9°F
LP discharge temperature	5°C	9°F	5°C	9°F

When a warning limit is reached, the relevant light diode will begin to flash slowly.

Provided normal conditions are ressumed, the warning light will stop and nothing more will happen.

However, if the warning limit is exceeded and the alarm limit reached, the compressor will stop and the relevant light diode will start to flash quickly.

Configuration

Open the door and put the jumper in **connected position**, (Changing parameters).

- Cut the power supply to the UNISAB control. Then press [RE-SET] keeping the key depressed while you reconnect power to the UNISAB control.
- The light diode in the ↕ column for SUCTION PRESSURE will now be lit and the VERSION light diode will flash to indicate that the system is in Configuration mode.
- Use ▶ and ▼ to reach the VERSION no. The LED will light constantly.
- Press [RE-SET]. The display will now show FAC to indicate FACTORY VALUES.

Important:

Once you have completed configuration remember to set the jumper in the **disconnected position.**

Make sure the jumper is firmly in place.

The system is brought out of **configuration** by the following.

- Switch off the power supply to the UNISAB Control.
- Switch the power supply on again. The UNISAB Control is now ready in normal position.

The system is brought out of RESET position by the following:

- Switch the power supply to the UNISAB control off for a moment.
- Switch the power supply on again. The UNISAB-control is now ready in normal position.

Connecting a thermistor

UNISAB control can be connected directly to the thermistors in the compressor's electric motor.

The connection must be made as shown on the wiring diagrams.

Note:
The thermistor doesn't have any independent warning or alarm function. However, if ↑ and ↓ diodes alongside **oil temperature** simultaneously flash quickly then there is a **thermistor alarm** which will stop the compressor.

Feed-back from the motor starter

UNISAB control must have feed-back from the motor starter (see the wiring diagram) via a potential-free switch.

If the UNISAB does not receive feed-back within 15 seconds from giving the start signal an alarm will be indicated in the *Motor current* field ↓.

If the feed-back cuts out during operation, the motor will be stopped immediately.

Compressor cooling

A thermostat function for both oil temperature regulation and liquid injection regulation are found in the UNISAB control.

Both regulators activate an output relay when the temperature exceeds +55°C (130°F) and cut out again when the temperature falls to 50°C (120°F), please refer to pos. 5.

The connection is shown on the wiring diagrams.

Service and calibration

Normally, it is not necessary to service UNISAB control, apart from calibrating the pressure transducers when they have been replaced, or if the UNISAB computer (cover) has been replaced.

Calibrating pressure transducers

The pressure transducers should be calibrated as follows:

- Equalize the pressure in the compressor to atmospheric, as described in the instruction manual for the compressor. This means that all the pressure transducers will have the same reference pressure.
- Bring the UNISAB control into configuration mode.
- Wait 10 - 15 seconds to allow all the measured values to settle.

♣ The diode alongside Suction Pressure in the ↕ column will light up and the measured value will appear in the display.

- Press the ▶ key to move to the Suction Pressure ↑ .
- The display will now show the transducer's current calibration value. If the measured value equals the calibration value, the pressure transducer for suction pressure is correctly calibrated.
- Go on to the next value and repeat the process.

If the two values are not the same:

- Press the **SET** key to calibrate the transducer.
- Continue to the next value and repeat the process.

The system is brought out of configuration mode. Se section entitled *Configuration.*

Note:
UNISAB-control is connected to pressure transducers on the following values:

- Suction pressure
- Discharge pressure
- Oil pressure
- Intermediate pressure (for two-stage compressors)

Measuring the motor current

UNISAB control has a 0-20 mA input which, when converted, can measure the compressor motor's current.

The converter, which is extra equipment, converts the 0-1 A/AC signal sent by the current transformer to 0-20 mA. Please refer to drawing no. **245560**.

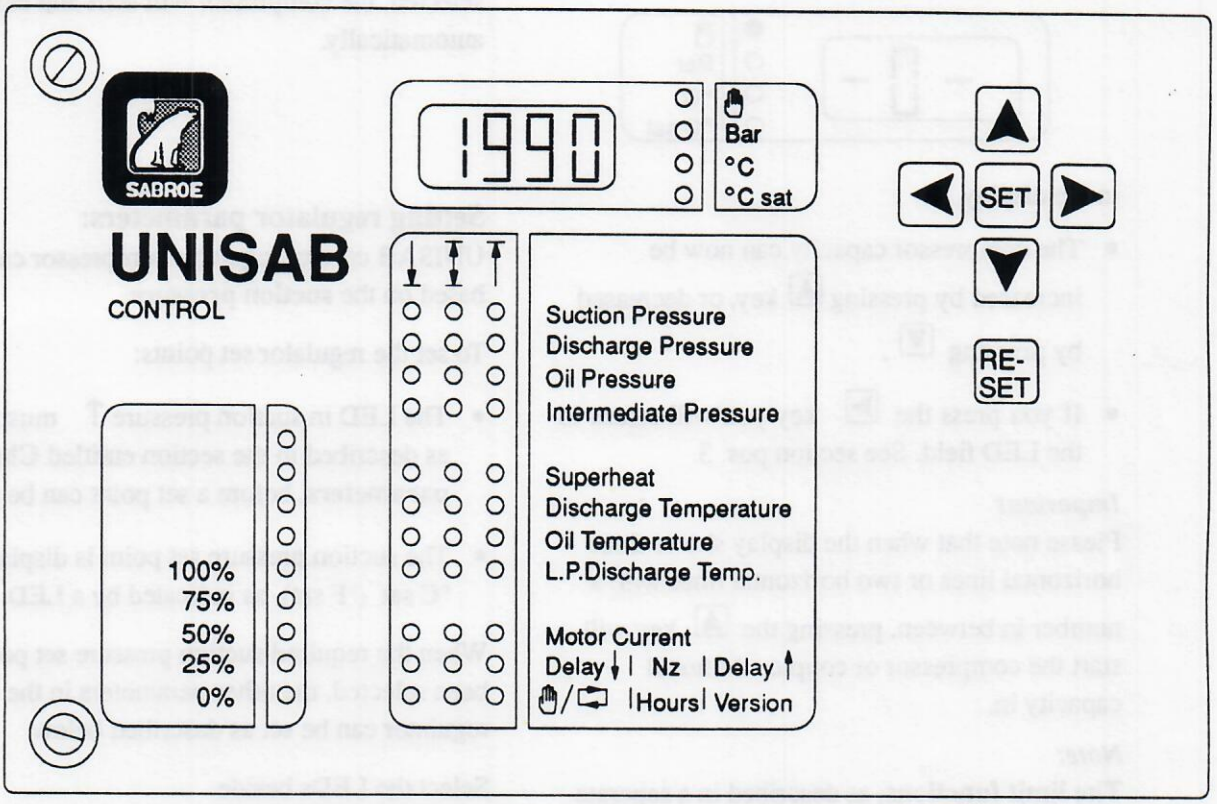
Use motor current scaling to make adjustments.

Scale the UNISAB, based on the currents transformer's conversion ratio, e.g. 0-1/200 Amp, using the ↓ field as described under the section entitled **Changing the parameters**.

For the example shown write a value of "200" in the display. The scaling is implemented once this has been done and the procedure for changing a parameter has been completed. The UNISAB control will now display the correct motor current while the compressor is in operation.

It may be necessary to calibrate the converter when starting up. This is done by measuring the motor current with a clamp ampmeter and calibrating the converter on "CAL" until the UNISAB shows the same as the clamp ampmeter.

Regulating and limit functions



UNISAB control has built in suction pressure regulation, which automatically regulates compressor capacity by coupling stages in or out, thus maintaining the required suction pressure. It is possible to regulate capacity **manually or have automatic parallel** operation by intercoupling several compressors, each fitted with UNISAB control.

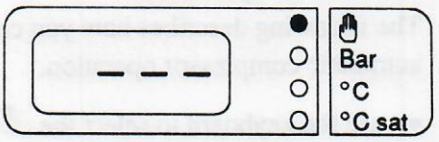
Manual operation

The following describes how you can select **manual** compressor operation:

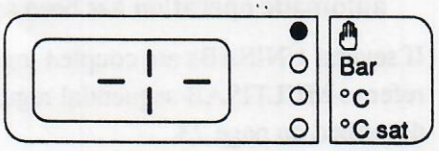
- Using the keyboard, select the ✋/⇦ field.
- Press the SET key momentarily. The LED alongside ✋ will light.

This indicates that **manual operation** has been selected.

- Press the ◀ key repeatedly until the display shows three horizontal lines.



- If you press the ▲ key, the compressor will start and the display will show:

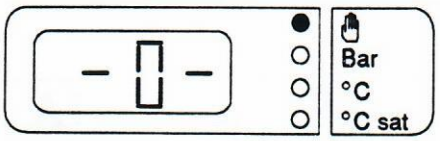


to indicate that the first stage of the compressor has been coupled in.

Note:

If your compressor can run at 0% capacity (i.e. if your compressor is fitted with special

equipment) pressing the ▲ key once will start the motor, which will be indicated by



in the display.

- The compressor capacity can now be increased by pressing ▲ key, or decreased by pressing ▼.
- If you press the ▶ key you will return to the LED field. See section pos. 3.

Important
Please note that when the display shows three horizontal lines or two horizontal lines with a number in between, pressing the ▲ key will start the compressor or couple additional capacity in.

Note:
The limit functions, as described in a seperate section, are also active for **manual operation**.

Automatic operation

The following describes how you can select automatic compressor operation.

- use the keyboard to select the ✋/↵ field.
- Press the SET key momentarily. The LED beside ✋ will go out to indicate that **automatic operation** has been selected.

If several UNISABs are coupled together, please refer to MULTISAB sequential regulation described on page 23.

Important:
Please note that when automatic operation is selected, the compressor will start and stop automatically.

Setting regulator parameters:

UNISAB control regulates compressor capacity based on the **suction pressure.**

To set the regulator set points:

- The LED in suction pressure ↑ must be lit, as described in the section entitled **Changing parameters**, before a set point can be set.
- The suction pressure set point is displayed in °C sat (°F sat), as indicated by a LED.

When the required suction pressure set point has been selected, the other parameters in the regulator can be set as described below.

Select the LEDs beside
Delay ↓ | Nz | Delay ↑
to access the following functions:

- Delay ↓ states the time delay in seconds between **coupling capacity stages out** when the load decreases.
- Nz is the **neutral zone** which states the extent to which the suction pressure can fluctuate without affecting the capacity stage of the compressor, i.e. set point ± 0.5 x Nz.
- Delay ↑ states the time delay in seconds between **coupling a capacity stage in** when the load increases.

Settings

The settings mentioned above must fall within the limits stated in the following table. You can use the "actual" column to note the actual settings.

	Range	Factory setting	Actual setting	
Set point	-60(-75) - 40 (100)	40 (100)		° C (°F)
Nz	0-10(20)	4 (7)		° C (°F)
Delay ↑	5-999	60		Sec
Delay ↓	5-999	60		Sec.

The settings can be changed - as described in the section entitled **Parameter changing**.

During operation, it is possible to see if the compressor capacity changes.

- slowly flashing light in Delay ↓ or Delay ↑ indicates that the regulator is changing the compressor capacity up or down as indicated.
- If there is no flashing light, the compressor is running at the set suction pressure, or within the neutral zone.

Limiting functions

UNISAB control has three basic limiting functions:

1. Low suction pressure
2. High discharge pressure
3. High motor current (only if a converter is fitted, as described under the section entitled **Measuring the motor current**).

Note:
The limit functions, which are active both for automatic and manual operation, overrule suction pressure regulation.

1. Low suction pressure

If the suction pressure falls to the warning limit (please refer to relevant section) the light diode in suction pressure ↓ will begin to flash slowly, and the compressor capacity will be reduced by one stage. If this isn't sufficient the capacity will be reduced further, after the Delay ↓ period has elapsed.

Note:
During manual operation, UNISAB control will endeavour to couple the set number of stages in when the suction pressure permits this.

When the suction pressure has risen by 8 °C sat (15 °F sat) above the alarm limit, the limit function will deactivate.

2. High discharge pressure

If the condensing pressure rises above the warning limit (please refer to the relevant section), the LED beside discharge pressure ↑ will begin to flash and the compressor capacity will be reduced by one stage. If this isn't sufficient the capacity will be reduced further, after the Delay ↓ period has elapsed.

Note:
During manual operation, UNISAB control will endeavour to couple the set number of stages in when the discharge pressure permits this.

When the discharge pressure has fallen 3 Bar (45 PSI) under the alarm limit, the limit function will deactivate.

3. High motor current

If the UNISAB control is equipped with a signal for **measuring the motor current** (please see the relevant section), the current limit function will also be active.

The limit required (typically the motor's nominal current - please see the label on the motor) should be set for motor current ↑ (please refer to the section entitled **Changing parameters**). If this limit is exceeded, the light diode will begin to flash and the compressor capacity will be reduced by one stage. If this isn't sufficient the capacity will be reduced further, after the Delay ↓ period has elapsed.

Important:
This function does not replace a thermal overload relay, which is still required.

Note:
During manual operation UNISAB control will endeavour to couple the set number of stages in when the motor current permits this.

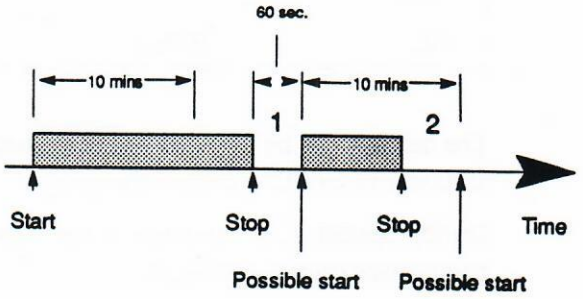
Delayed restart function

To avoid the compressor and motor starting and stopping frequently (cycling), UNISAB control has a timer function

This function, which cannot be changed by the user, ensures that:

- The compressor/motor cannot restart less than 10 minutes after the previous start.
- 60 seconds must elapse before the compressor can start after a stop.

The following drawing illustrates the function.



During periods 1 and 2, the LED beside motor current ↑ will flash to indicate that it is not possible to restart before the time specified by the timer function has elapsed.

Note:
Delayed restart function does not function with **manual operation.**

External start

In automatic operation, UNISAB control can be controlled through a potential-free switch which is connected to an output (see the wiring diagram).

- When the contact is open the compressor will not start.
- When the contact is closed the compressor can start when necessary.
- When the UNISAB control is delivered, the input is shorted.

MULTISAB sequential regulation of reciprocating compressors

UNISAB control has a communications module which enables up to 14 compressors to be coupled together as one integrated system, which can be regulated as such.

Each UNISAB control is inter-connected with a 2-core screened cable – please refer to instruction no. **0171-732** "Installation of data communications cable".

The compressors must be numbered consecutively starting with number 1 – i.e a *compressor number*.

To enter this compressor number, select **configuration** mode.

- select ✋/⇨ and code in the compressor number following the procedure described in "**Changing parameters**".
- Switch the UNISAB control off and on again to return to normal operation. Repeat this process on all the compressors, fitted with UNISAB control, coupled in the MULTISAB system.
- Set the set point for the suction pressure regulator in all the UNISABs as required.

The **MULTISAB sequence system will use the UNISAB control on compressor no. 1 as basis for regulating the complete system**, provided power is not cut off.

If a power cut occurs, the MULTISAB system will promote the next compressor in the sequence which will then control system regulation. The system is, therefore, most secure if all the set points are the same.

Finally, each compressor is allocated a position in the start sequence, this is coded in the ✋/⇨ field. Please refer to the section entitled **Changing parameters**. This position is defined by means of a sequence number.

Compressor no.	1	2	3	4	5	–	–	–	–	14
Start no.	2	3	4	5	1	–	–	–	–	–

In the example shown there are five compressors, numbered 1 to 5 (each compressor should be labelled to avoid confusion). The start no. must be coded into each UNISAB control. As can be seen in the table, compressor no. 1 has been allocated start no. 2. Compressor number 2 has been allocated start no. 3 and so on. This means that compressor no. 5 will start first, compressor no. 1 will start next, then compressor no. 2 and so on. If the load requirement increases, each compressor will couple all capacity stages in before the next compressor starts. And the reverse applies when the load requirement decreases, although one capacity stage will be coupled out on the previous compressor in the sequence first. If the load requirement continues to decrease, the initial compressor (running on minimum capacity) will stop.

The system will ignore one or more compressors in **alarm** situation, or if they have been changed to **manual operation**. The compressors remaining in the system will still be regulated.

A compressor which has been RESET after an alarm, or changed from manual to automatic operation, will after a period resume its position in the sequence.

It is always easy to identify which UNISAB controls system regulation – a light will flash in the Delay ↓ or Delay ↑ LED in the relevant UNISAB panel, depending on whether the capacity is being increased or decreased.

Local automatic

Normally, when several UNISAB controls are coupled together, one UNISAB regulates all compressors, as described above. However, if a UNISAB is set to **local automatic operation** it will be controlled by its own regulator.

To activate the local automatic function, the start number for the UNISAB control in question should be **0**. The UNISAB must be in automatic operation for this function to apply.

Replacing parts

UNISAB control comprises two basic parts:

- the **power** section in the base of the box where all components connected to the main voltage are fitted on a common printed circuit board (PCB).

If a fault occurs, we would recommend that you replace the complete PCB in agreement with SABROE.

The print board can be removed from the box by unscrewing the 14 nuts NV 5,5.

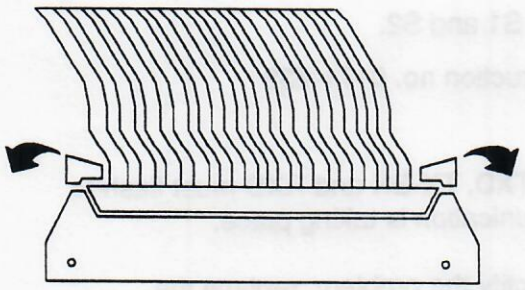
The power section is protected by a fuse 315 mA/250 V/AC eller 630 mA/110 V/AC fitted on the PCB as shown on the drawing on page 6.

- the **computer** section is fitted in the cover and protected by a strong plate screen.

We would not recommend repairing this section – replace the complete cover with a new unit in agreement with SABROE.

The parts are replaced as follows:

- Disconnect the power supply.
- Remove the electric multiplug from the heavy current section of the print board. As the drawing illustrates, the two locking pawls should be twisted to each side. You can then pull the multiplug with the flat cable out of the socket.
- Unscrew the 2 screws that fasten the cover to the hinges. The complete cover with computer can then be removed.



When you replace the multiplug, press the plug down and put the locking pawls firmly into place, as shown in the drawing.

Transfer the EPROM unit from the deffective module to the new module. Please refer to instruction no. 0171-756.

Recalibrate the transducer as described in the following:

Calibrating pressure transducers when replacing the computer:

At delivery, the blue label on the inside of the UNISAB cover will indicate the value for each pressure transducer.

These values must be coded into the new computer.

- Once the new computer has been fitted, bring the UNISAB into configuration mode.
- Now select suction pressure ↑ and code the value for suction pressure stated on the blue label in. (See section entitled: **Changing paramets**).
- Repeat the procedure for discharge pressure, oil pressure and intermediate pressure (two-stage compressors).
- Select *VERSION* and press the **RESET** key to set the factory values (FAC in the display).
- Cut the power supply to the UNISAB control. Reconnect right away and the UNISAB-control is ready to operate.

The actual limit values should then be coded in (See the section entitled **Parameter changing**).

Trouble shooting

Note
UNISAB control contains live parts and may only be serviced by authorized personnel.

Warning:

Even though the power supply to UNISAB is switched off, some of the terminals may still be live.

Before trying to trace a fault, cut out the compressor motor starter to prevent accidental start.

Fault	
No light in the front panel.	– Is the LED to the right of the transformer switched on? – Check the fuse. – Check the voltage. If yes, proceed as follows: – Check the red and green LEDs through the holes in the inside of the door. If they are not lit, replace the computer (door). (Please refer to the section entitled: Calibrating pressure transducers when replacing the computer)
Coupling out due to alarm which can't be reset.	The measuring value must be within the alarm limits. – Check the measuring value. If it is very high or low, check the sensor for breaks or shorts. – If the sensor is faulty, replace it. – If you replace the pressure transducer, remember to calibrate it as described in: Kalibrating pressure transducers.
The sequence regulation (2 or more compressors) is not functioning.	This may be due to a faulty communications card. – Check the cables – Check the jumpers S1 and S2. Please refer to instruction no. 0171-732 – LED 4 must be lit. – The LEDs marked TXD, TX-EN and RXD must flash to indicate that communication is taking place. If these checks don't rectify the problem, replace the communications card.

UNISAB - CONTROL

DRAWING LIST

DRAWING NO. 245.558

ELECTRICAL SPECIFICATION:

DRAWING NO. 245.559

UNISAB:

WIRING DIAGRAM:

SCHEMATIC CONTROL DIAGRAM:

DRAWING NO. 245.560 ▲ OPTION

SCHEMATIC CONTROL DIAGRAM:

DRAWING NO. 245.561 ▲ OPTION

EMERGENCY STOP BOX:

WIRING DIAGRAM:

SCHEMATIC CONTROL DIAGRAM:

DRAWING NO. 245.562 GUIDING

S/D STARTER/EMERGENCY STOP:

REVISION:

SABROE
P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED: LSS 900109
DRAWN: VIW
CHECKED:
APPROVED:
MF: X

CLIENT
CONTRACT

TITLE
ELECTRICAL SPECIFICATION
DRAWING LIST
UNISAB - CONTROL

DRAWING NO. 245.558
REV.NO. 0
PAGE 1/2
ORDER NO.

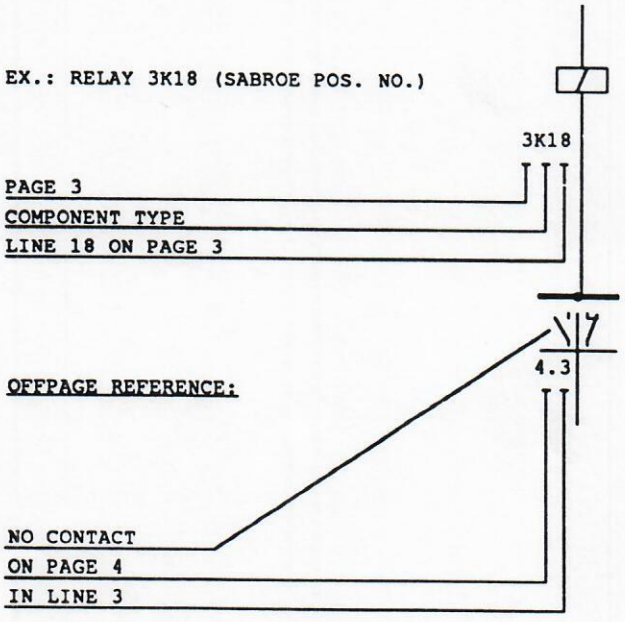
PRODUCED BY VIW DRAWING FILENAME T245558_0
ON 15/01/90 AT 14:49 PLOTTED AT SCALE 1/1

SYMBOLS:

- ⌀ TERMINAL IN CONTROL PANEL
- ⌀ TERMINAL IN EXTERNAL PANEL
- ——— INTERNAL WIRING
- - - - EXTERNAL WIRING
- ▲ OPTIONAL EQUIPMENT

REFERENCE SYSTEM:

EX.: RELAY 3K18 (SABROE POS. NO.)



REVISION:

SABROE
P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06) 271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED: LSS 900109
DRAWN: VIW
CHECKED:
APPROVED:
MF: K

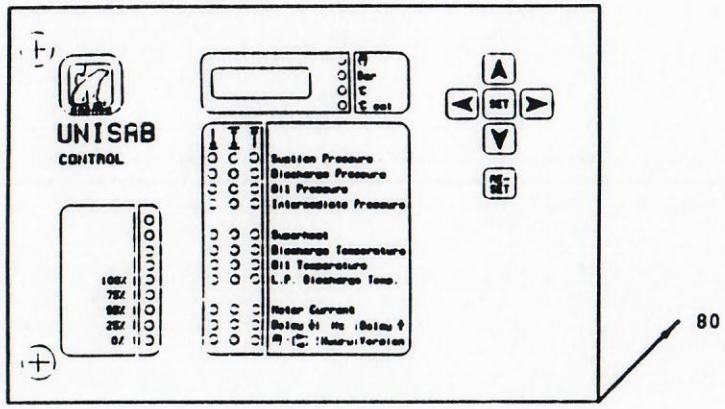
CLIENT
CONTRACT

TITLE
ELECTRICAL SPECIFICATION
SYMBOLS, REFERENCE SYSTEM
UNISAB - CONTROL

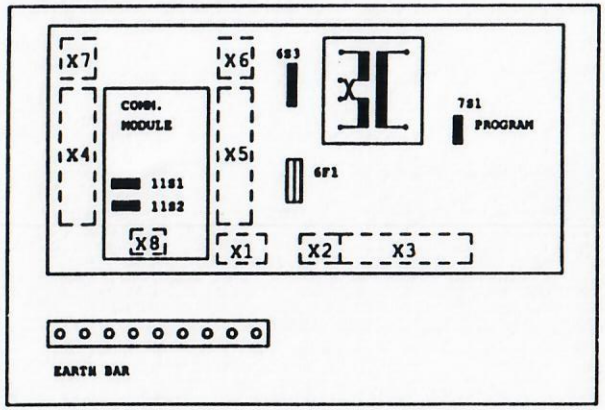
DRAWING NO. 245.558
PAGE 1/1
ORDER NO.
REV.NO. 0

PRODUCED BY VIW DRAWING FILENAME T245558_0
ON 15/01/90 AT 16:40 PLOTTED AT SCALE 1/1

FRONT VIEW



ARRANGEMENT



PART LIST

ITEM	COMPONENT	DESCRIPTION	PAGE
6F1	FUSE	315 MA - 230V AC 630 MA - 115V AC	6.1
11S1	JUMPER	COMMUNICATION MODULE	11.1
11S2	JUMPER	COMMUNICATION MODULE	11.1
6S3.1	JUMPER	POWER SUPPLY 230V AC	6.3
6S3.2	JUMPER	POWER SUPPLY 115V AC	6.3
7S1	JUMPER	PARAMETER CHANGING	7.1
X1	TERMINAL BLOCK	POWER SUPPLY	6
X2	TERMINAL BLOCK	DIGITAL INPUT	6
X3	TERMINAL BLOCK	ANALOGUE INPUT	7, 8
X4	TERMINAL BLOCK	DIGITAL OUTPUT	9
X5	TERMINAL BLOCK	DIGITAL OUTPUT	9
X6	TERMINAL BLOCK	DIGITAL OUTPUT-START	10
X7	TERMINAL BLOCK	DIGITAL OUTPUT-ALARM	10
X8	TERMINAL BLOCK	COMMUNICATION	11

REVISION:

SABROE
P.O. BOX 1010, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED: LSS 89.12.07
DRAWN: VIN
CHECKED:
APPROVED:
MF: X

CLIENT
CONTRACT

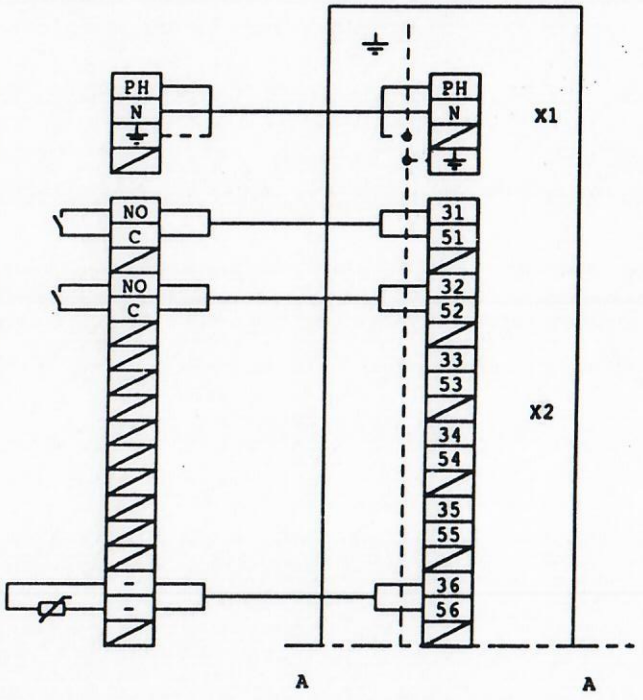
TITLE UNISAB
FRONT VIEW, ARRANGEMENT
AND PART LIST
UNISAB - CONTROL

DRAWING NO. 245.559
PAGE 1/11
ORDER NO.

REV.NO. 0

PRODUCED BY VIN
ON 15/01/90 AT 16:02
DRAWING FILENAME T245559_0
PLOTTED AT SCALE 1/1

COMPONENT/UNIT						CABLE	UNISAB
SABROE POS. NO.	REMARK	NOTE	MAKE	TYPE	TERMINAL NO.		TERMINAL NO.
—	USER CONNECTION	POWER SUPPLY 115VAC OR 230VAC NOTE CORRECT JUMPER	—	—			
10A12	USER CONNECTION	COMPR. MOTOR RUNNING SEE DRWG. NO. 245.561 OR DRWG. NO. 245.562	—	—			
6A8	USER CONNECTION	EXTERNAL STARTING PERMISSION	—	—			
—	—	DIGITAL INPUT NOT USED	—	—			
—	—	DIGITAL INPUT NOT USED	—	—			
—	—	DIGITAL INPUT NOT USED	—	—			
6R16	—	AVAILABLE FOR THERMISTOR IN MOTOR WINDINGS	—	—			



REVISON:

SABROE
P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED: LSS 89.12.07
DRAWN: VIW
CHECKED:
APPROVED:
MF: X

CLIENT

CONTRACT

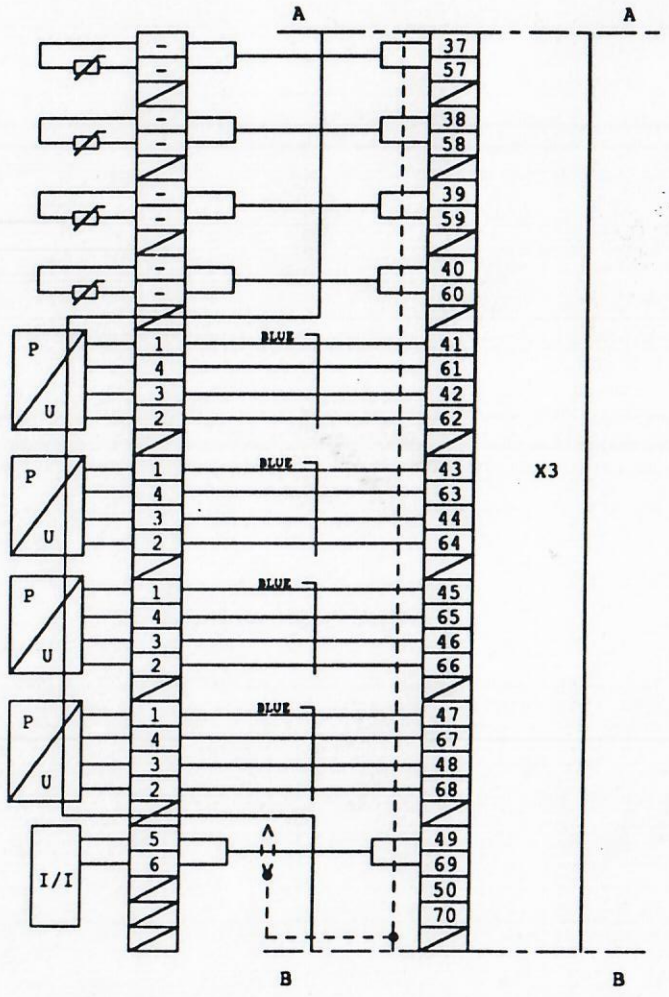
TITLE
WIRING DIAGRAM
POWER SUPPLY/DIGITAL INPUT
UNISAB - CONTROL

DRAWING NO. 245.559
PAGE 2/11
ORDER NO.

REV.NO. 0

PRODUCED BY VIW
ON 16/01/90 AT 9:51
DRAWING FILENAME T245559_0
PLOTTED AT SCALE 1/1

COMPONENT/UNIT						CABLE	UNISAB
SABROE POS. NO.	REMARK	NOTE	MAKE	TYPE	TERMINAL NO.		TERMINAL NO.
7R3	—	SUCTION TEMPERATURE PT 100-SENSOR NO. 1	KAMSTRUP-METRO A/S	1373.244			
7R5	—	DISCHARGE TEMPERATURE PT 100-SENSOR NO. 2	KAMSTRUP-METRO A/S	1373.244			
7R7	—	OIL TEMPERATURE PT 100-SENSOR NO. 3	KAMSTRUP-METRO A/S	1373.244			
7R9	ONLY FOR TWO STAGE COMPRESSORS	INTERMEDIATE TEMPERATURE PT 100-SENSOR NO. 4	KAMSTRUP-METRO A/S	1373.244			
8U2	ONLY FOR TWO STAGE COMPRESSORS PLACED INSIDE UNISAB	INTERMEDIATE PRESSURE PRESSURE TRANSDUCER SENSOR NO. 1 0-500 PSIG	MEDIAMATE	1373.243			
8U6	PLACED INSIDE UNISAB	DISCHARGE PRESSURE PRESSURE TRANSDUCER SENSOR NO. 2 0-500 PSIG	MEDIAMATE	1373.243			
8U10	PLACED INSIDE UNISAB	SUCTION PRESSURE PRESSURE TRANSDUCER SENSOR NO. 3 0-200 PSIG	MEDIAMATE	1373.242			
8U14	PLACED INSIDE UNISAB	OIL PRESSURE PRESSURE TRANSDUCER SENSOR NO. 4 0-500 PSIG	MEDIAMATE	1343.243			
7A13	▲ OPTION USER CONNECTION	MOTOR CURRENT INPUT CURRENT CONVERTER SEE DRWG. NO. 245.560	LODAM AUTOMATIC A/S	1556.032			



REVISON:

SABROE

P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED:	LSS 89.12.07
DRAWN:	VIW
CHECKED:	
APPROVED:	
MF:	X

CLIENT

CONTRACT

TITLE

WIRING DIAGRAM
ANALOGUE INPUT
UNISAB - CONTROL

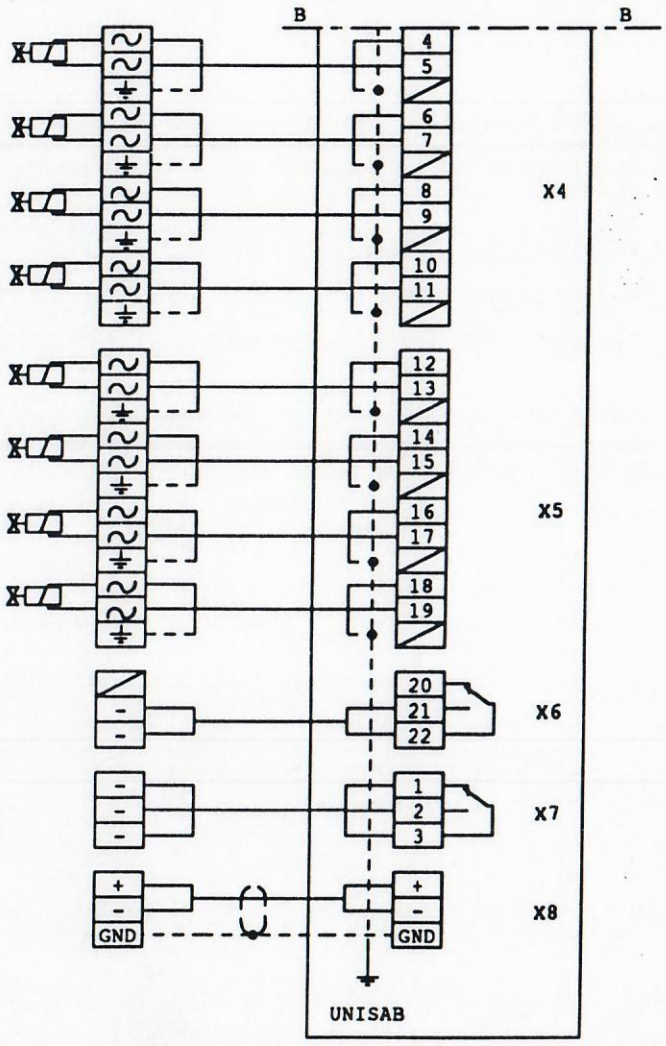
DRAWING NO. 245.559
PAGE 3/11
ORDER NO.

REV.NO. 0

PRODUCED BY VIW
ON 16/01/90 AT 9:51

DRAWING FILENAME T245559_0
PLOTTED AT SCALE 1/1

COMPONENT/UNIT						CABLE	UNISAB
SABROE POS. NO.	REMARK	NOTE	MAKE	TYPE	TERMINAL NO.		TERMINAL NO.
9Y1 9Y3	—	S-VALVE SOLENOID VALVE SEE PAGE 5/11	—	—			
9Y5	—	CAPACITY STEP 1 SOLENOID VALVE SEE PAGE 5/11	—	—			
9Y7	—	CAPACITY STEP 2 SOLENOID VALVE SEE PAGE 5/11	—	—			
9Y9	—	CAPACITY STEP 3 SOLENOID VALVE SEE PAGE 5/11	—	—			
9Y11	—	CAPACITY STEP 4 SOLENOID VALVE SEE PAGE 5/11	—	—			
9Y13	—	CAPACITY STEP 5 SOLENOID VALVE SEE PAGE 5/11	—	—			
9Y15	—	CAPACITY STEP 6/ LIQUID INJECTION SOLENOID VALVE SEE PAGE 5/11	—	—			
9Y17	—	OIL COOLING SOLENOID VALVE SEE PAGE 5/11	—	—			
10K7	USER CONNECTION	START SIGNAL TO COMPRESSOR MOTOR SEE DRWG. NO. 245.561 OR DRWG. NO. 245.562	—	—			
10K3	USER CONNECTION	ALARM SIGNAL SEE PAGE 10/11	—	—			
11U3	USER CONNECTION	COMMUNICATION MODULE	—	—			



REVISON:

SABROE

P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED: LSS 89.12.07	
DRAWN: VIW	
CHECKED:	
APPROVED:	
MF: X	

CLIENT

CONTRACT

TITLE
WIRING DIAGRAM
DIGITAL OUTPUT
UNISAB - CONTROL

DRAWING NO. 245.559
PAGE 4/11
ORDER NO.

REV.NO. 0

PRODUCED BY VIW
ON 15/01/90 AT 16:41
DRAWING FILENAME T245559_0
PLOTTED AT SCALE 1/1

COMPRESSOR

SOLENOID VALVES

	SINGLE STAGE								SINGLE STAGE WITH UNLOADING VALVE								TWO STAGE			
	CMO 24,26,28	SMC 104	SMC 106	SMC 108	SMC 112	SMC 116	SMC 186	SMC 188	SMC 104+UNLOADING	SMC 106+UNLOADING	SMC 108+UNLOADING	SMC 112+UNLOADING	SMC 116+UNLOADING	SMC 186+UNLOADING	SMC 188+UNLOADING	TCMO 28	TSMC 108	TSMC 116	TSMC 188
S-VALVE	—	—	—	—	—	—	—	—	S	S	S	2xS	2xS	S	S	S	S	2xS	S
CAPACITY STEP 1	3	1	2	3	4	6	2	3	1	2	3	4	6	2	3	3	2	5	2
CAPACITY STEP 2	2	—	1	2	3	5	1	2	—	1	2	3	5	1	2	2	1	4	1
CAPACITY STEP 3	1	—	—	1	2	4	—	1	—	—	1	2	4	—	1	1	—	3	—
CAPACITY STEP 4	—	—	—	—	1	3	—	—	—	—	—	1	3	—	—	—	—	2	—
CAPACITY STEP 5	—	—	—	—	—	2	—	—	—	—	—	—	2	—	—	—	—	1	—
CAPACITY STEP 6/ LIQUID INJECTION	—	—	—	—	—	1	—	—	—	—	—	—	1	—	—	X	X	X	X
OIL COOLING	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	—	O	O	O

UNLOADING SEQUENCE

1-6: NUMBER IN UNLOADING SEQENCE
S : TOTAL UNLOADED START
X : LIQUID INJECTION ALWAYS INCLUDED
O : OIL COOLING WHEN INCLUDED

SEE PAGE 4/11

REVISON:

SABROE
P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED: LSS 89.12.07
DRAWN: VIW
CHECKED:
APPROVED:
MF: X

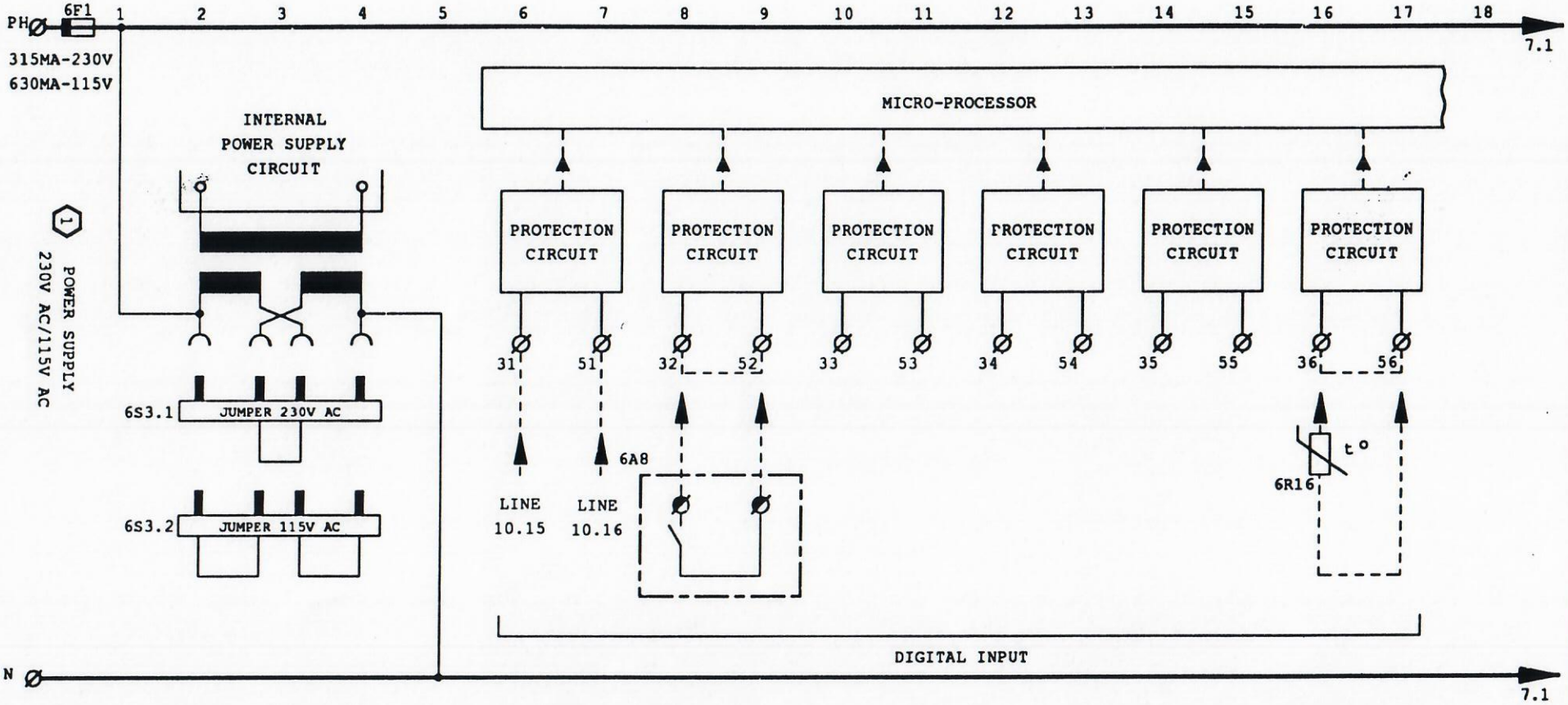
CLIENT
CONTRACT

TITLE WIRING DIAGRAM
SOLENOID VALVES CONNECTION/
COMPRESSOR TYPE
UNISAB - CONTROL

DRAWING NO. 245.559
PAGE 5/11
ORDER NO.

REV.NO. 0

PRODUCED BY VIW ON 15/01/90 AT 16:41
DRAWING FILENAME T245559_0
PLOTTED AT SCALE 1/1



1 WHEN EMERGENCY STOP BOX IS INCLUDED SEE DRAWING NO. 245.561

AVAILABLE FOR THERMISTOR IN MOTOR WINDINGS WHEN USED - REMOVE JUMPER BETWEEN TERMINAL 36 AND TERMINAL 56

NOT USED

NOT USED

EXTERNAL STARTING PERMISSION WHEN USED - REMOVE JUMPER BETWEEN TERMINAL 32 AND TERMINAL 52

COMPRESSOR MOTOR RUNNING FEED BACK

REVISON:

SABROE

P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED: LSS 89.12.07
DRAWN: VIW
CHECKED:
APPROVED:
MF: X

CLIENT

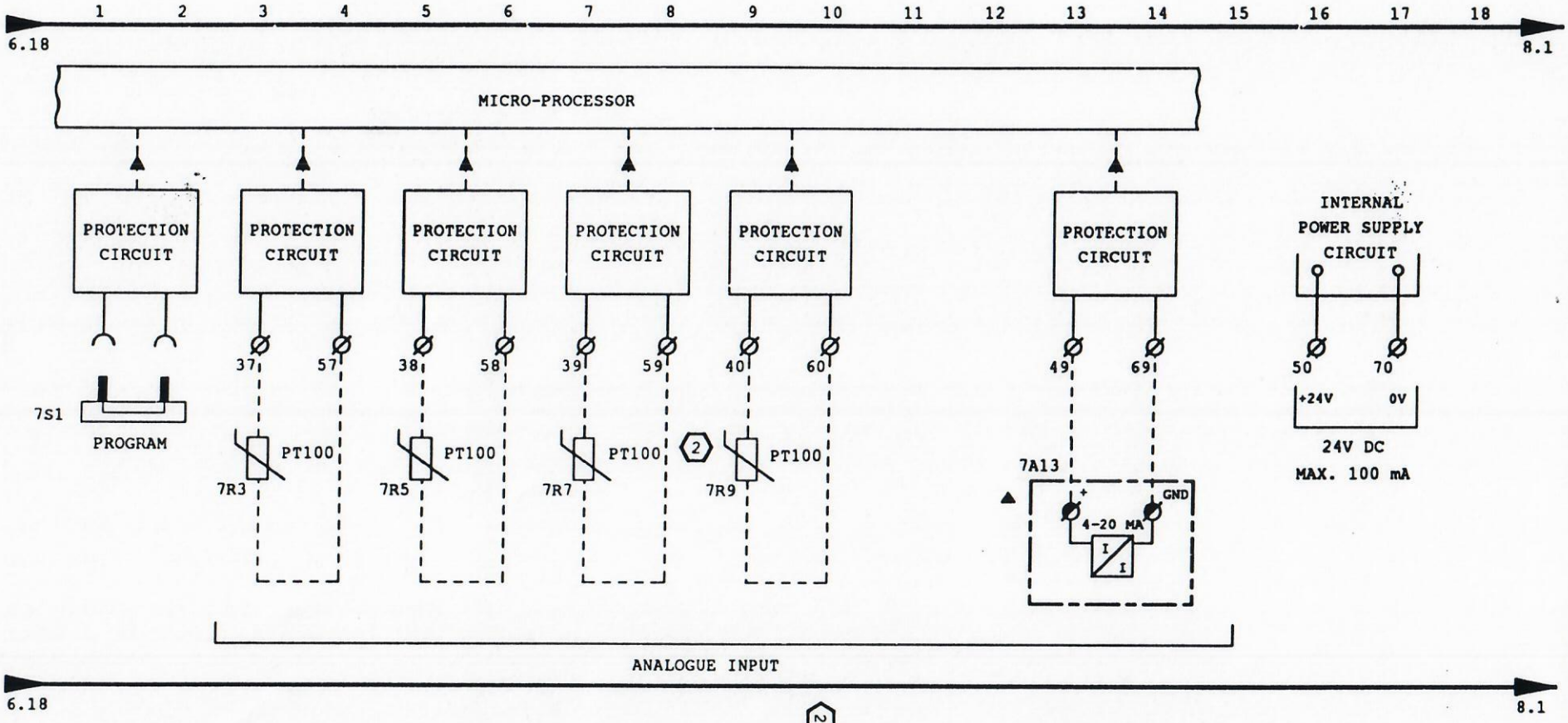
CONTRACT

TITLE
SCHEMATIC CONTROL DIAGRAM
DIGITAL INPUT
UNISAB - CONTROL

DRAWING NO. 245.559
PAGE 6/11
ORDER NO.

REV.NO. 0

PRODUCED BY VIW
ON 15/01/90 AT 16:41
DRAWING FILENAME T245559_0
PLOTTED AT SCALE 1/1



REVISON:

SABROE
P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

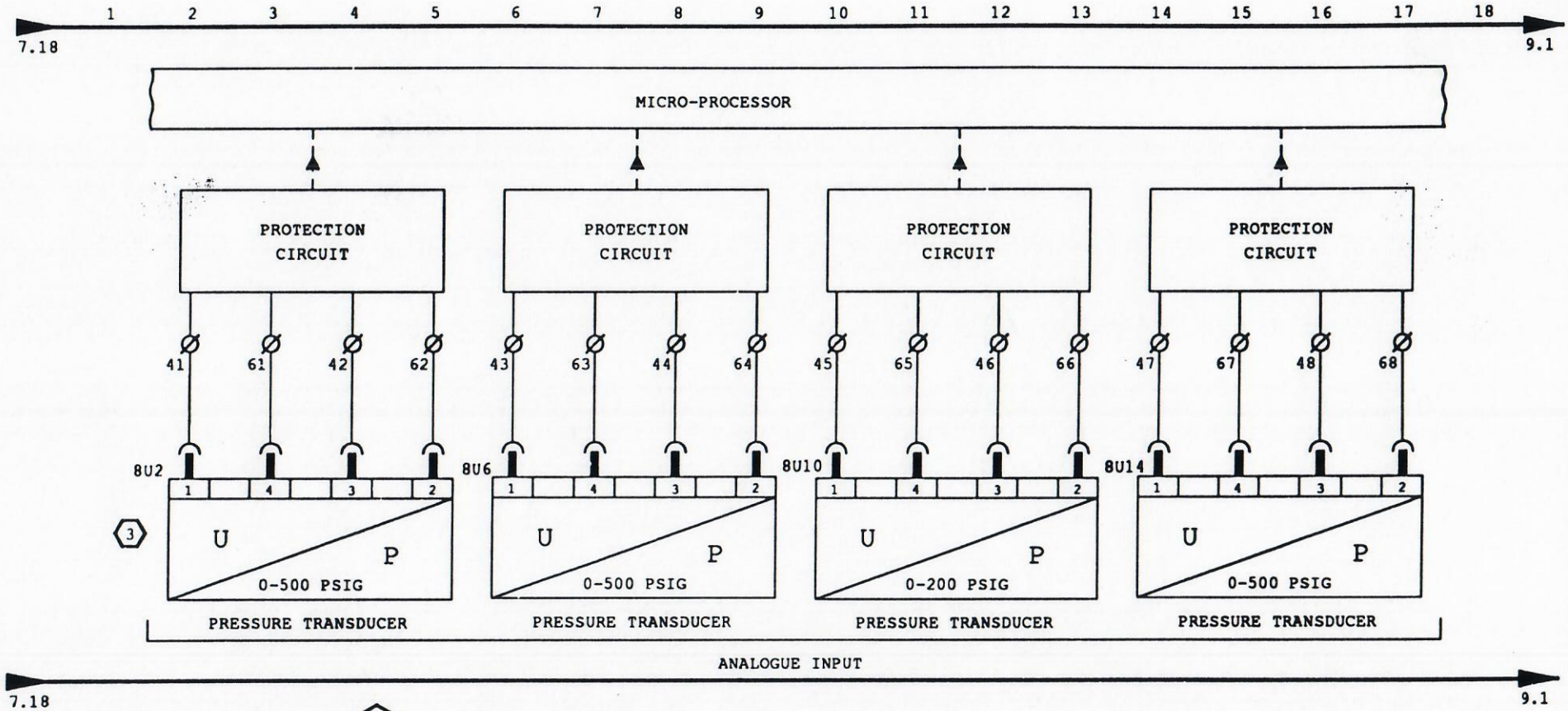
DESIGNED: LSS 89.12.07	CLIENT
DRAWN: VIW	
CHECKED:	CONTRACT
APPROVED:	
MF:	

TITLE
SCHEMATIC CONTROL DIAGRAM
ANALOGUE INPUT
UNISAB - CONTROL

DRAWING NO. 245.559
PAGE 7/11
ORDER NO.

REV.NO. 0

PRODUCED BY VIW
ON 15/01/90 AT 16:41
DRAWING FILENAME T245559_0
PLOTTED AT SCALE 1/1



REVISON:

SABROE

P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED: LSS 89.12.07	
DRAWN: VIW	
CHECKED:	
APPROVED:	
MF: X	

CLIENT

CONTRACT

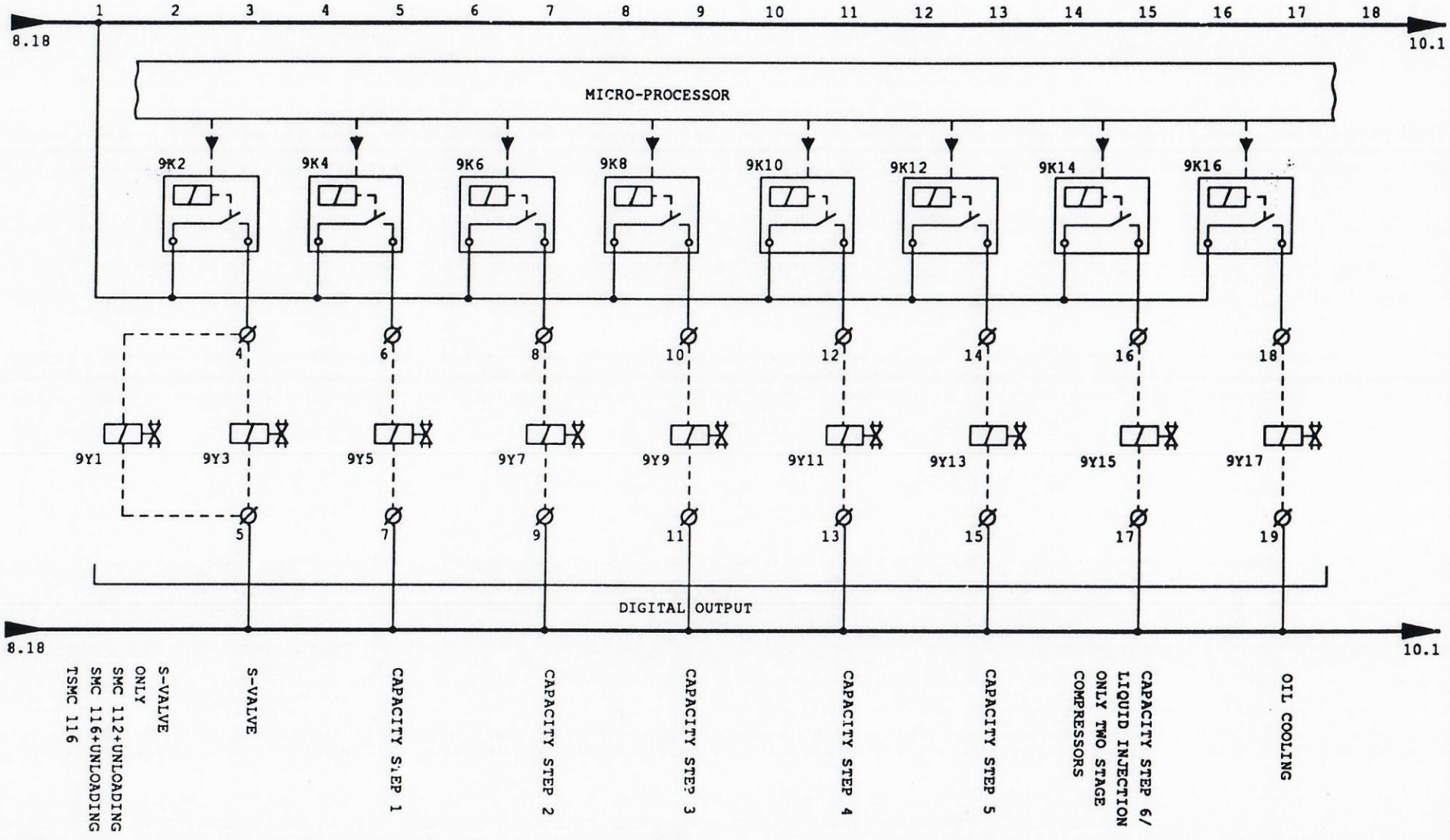
TITLE

SCHEMATIC CONTROL DIAGRAM
ANALOGUE INPUT
UNISAB - CONTROL

DRAWING NO. 245.559
PAGE 8/11
ORDER NO.

REV.NO. 0

PRODUCED BY VIW
ON 15/01/90 AT 16:41
DRAWING FILENAME T245559_0
PLOTTED AT SCALE 1/1



REVISON:

SABROE
P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED: LSS 89.12.07	
DRAWN: VIW	
CHECKED:	
APPROVED:	
MF: X	

CLIENT

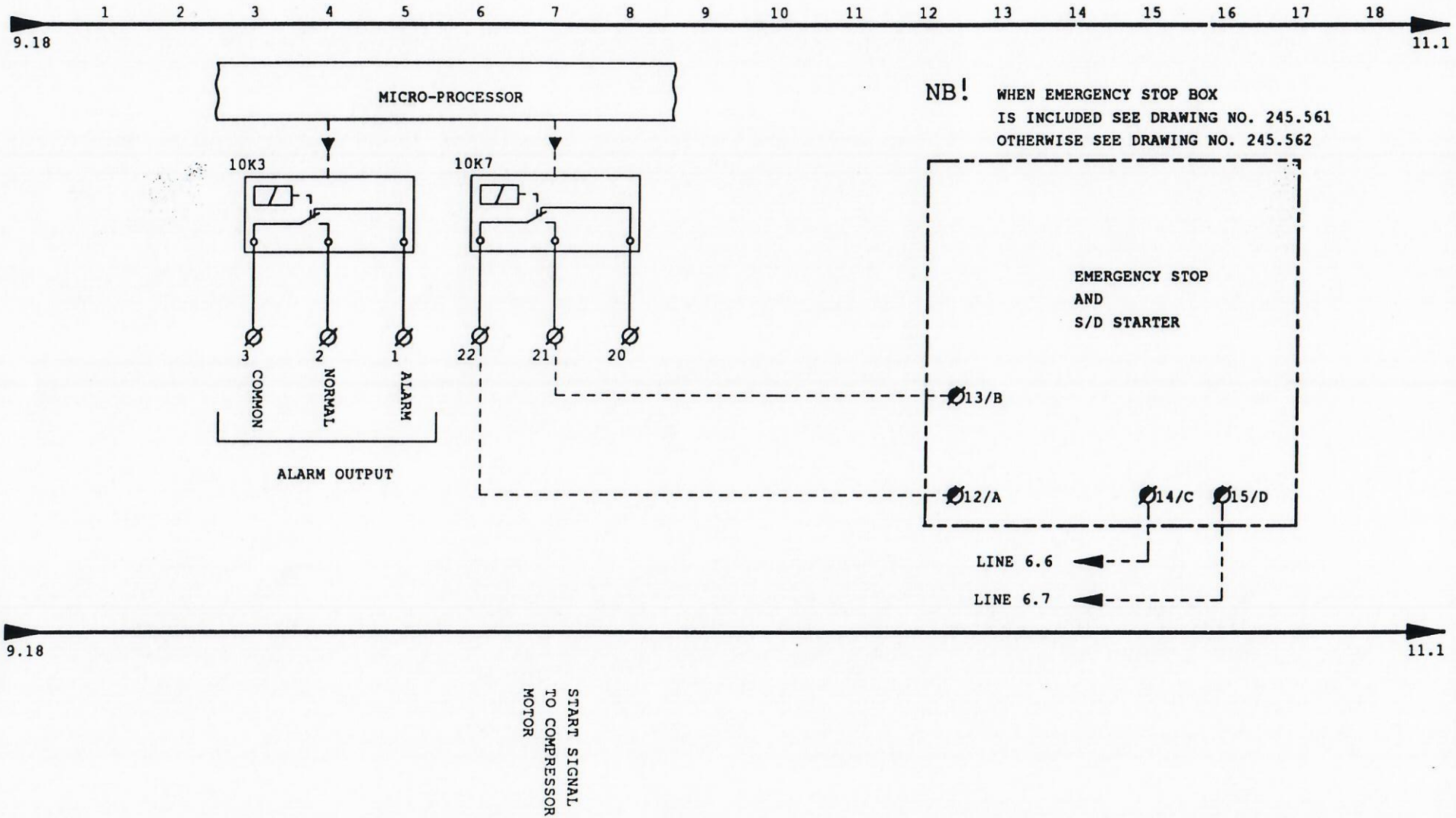
CONTRACT

TITLE
SCHEMATIC CONTROL DIAGRAM
DIGITAL OUTPUT
UNISAB - CONTROL

DRAWING NO. 245.559
PAGE 9/11
ORDER NO.

REV.NO. 0

PRODUCED BY VIW
ON 16/01/90 AT 9:51
DRAWING FILENAME T245559_0
PLOTTED AT SCALE 1/1



REVISON:

SABROE
P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED: LSS 89.12.07	
DRAWN: VIW	
CHECKED:	
APPROVED:	
MF: X	

CLIENT

CONTRACT

TITLE
SCHEMATIC CONTROL DIAGRAM
DIGITAL OUTPUT
UNISAB - CONTROL

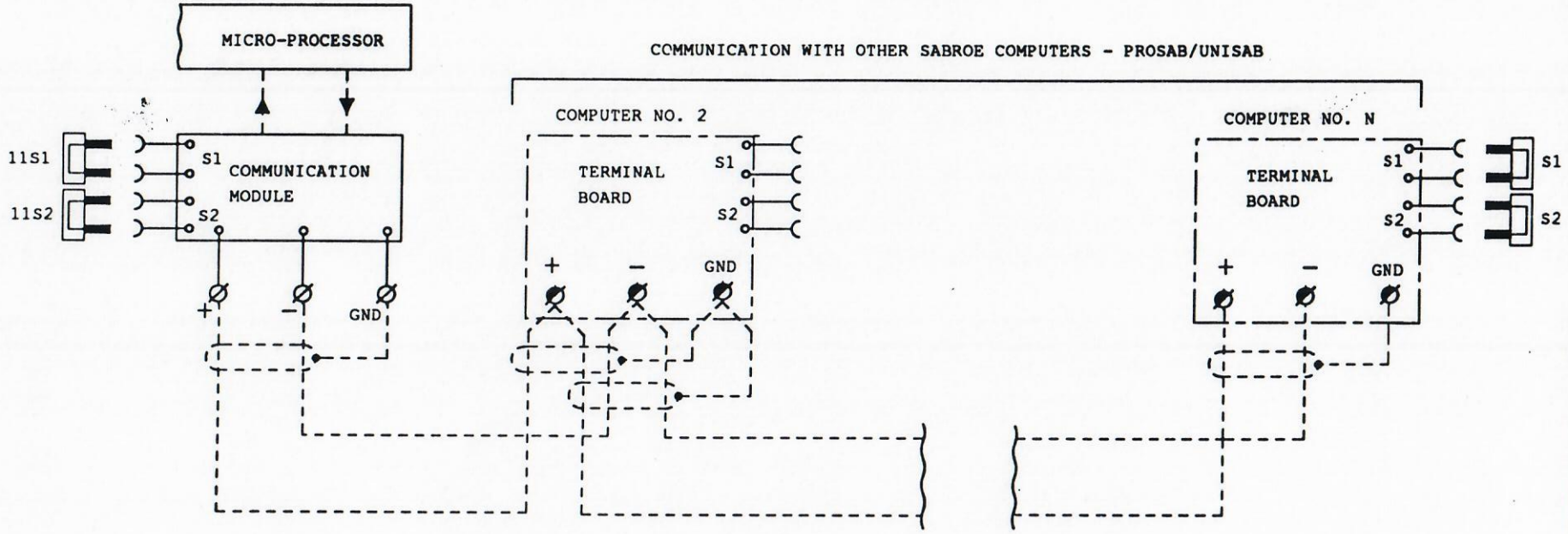
DRAWING NO. 245.559
PAGE 10/11
ORDER NO.

REV.NO. 0

PRODUCED BY VIW
ON 15/01/90 AT 14:41
DRAWING FILENAME T245559_0
PLOTTED AT SCALE 1/1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

10.18



10.18

WHEN COMMUNICATION TO OTHER SABROE COMPUTERS - PROSAB/UNISAB - IS USED, JUMPERS S1 AND S2 MUST BE MOUNTED IN COMPUTER 1 AND COMPUTER N.

ALSO SEE SABROE INSTRUCTION NO. 0171-732

REVISON:

SABROE
P.O. BOX 1010, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

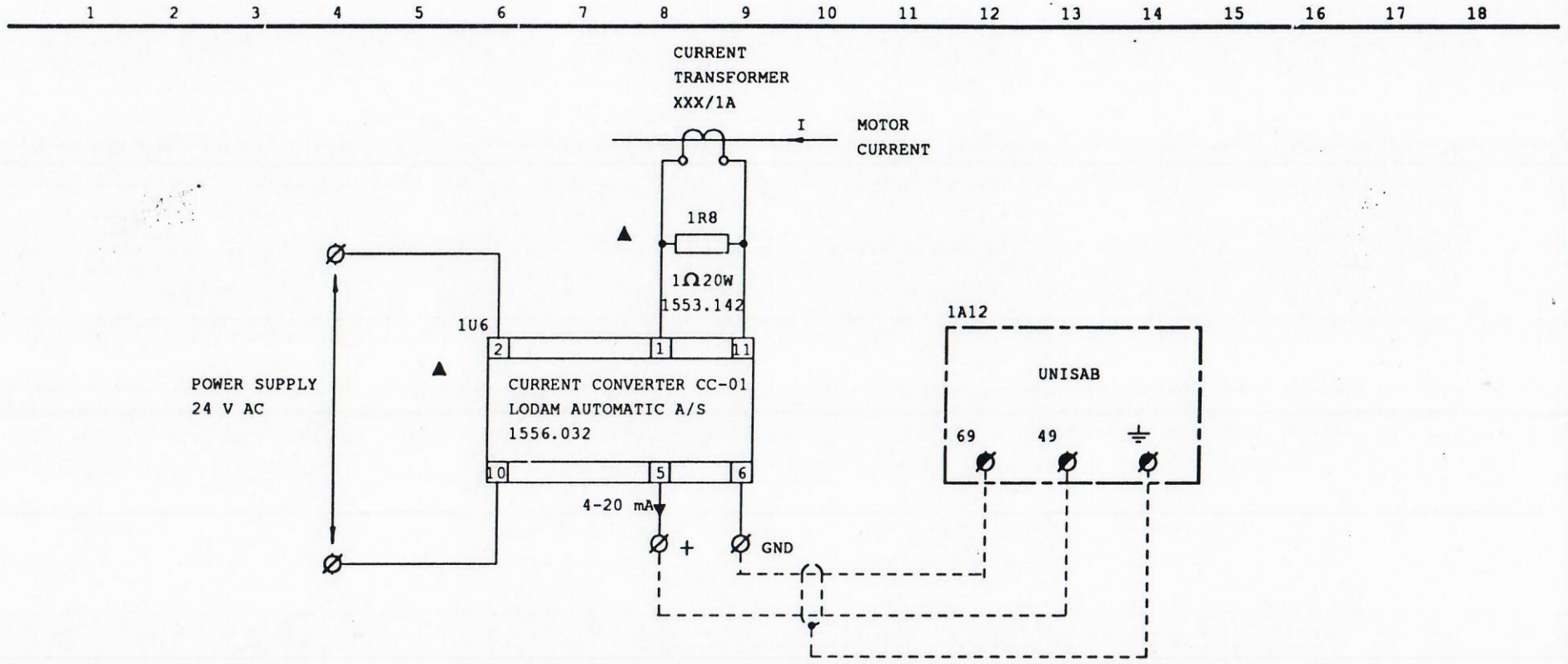
DESIGNED: LSS 89.12.07	CLIENT
DRAWN: VIW	
CHECKED:	CONTRACT
APPROVED:	
MF: X	

TITLE
SCHEMATIC CONTROL DIAGRAM
COMMUNICATION
UNISAB - CONTROL

DRAWING NO. 245.559
PAGE 11/11
ORDER NO.

REV.NO. 0

PRODUCED BY VIW ON 16/01/90 AT 13:31
DRAWING FILENAME T245559_0
PLOTTED AT SCALE 1/1



SEE DRAWING NO. 245.559

ITEMS TO BE MOUNTED AND POWER SUPPLIED BY USER

UNISAB

▲ OPTIONAL EQUIPMENT

REVISON:

SABROE
P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED: LSS 891208	CLIENT
DRAWN: CHN	
CHECKED:	CONTRACT
APPROVED:	
MF: X	

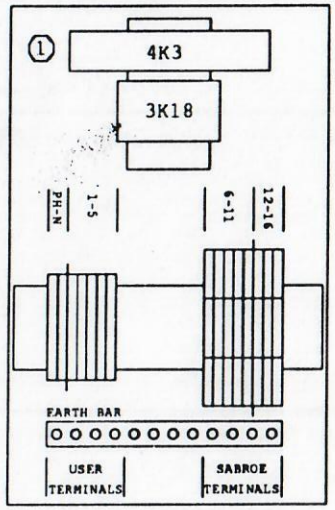
TITLE
SCHEMATIC CONTROL DIAGRAM
MOTOR CURRENT
UNISAB-CONTROL

DRAWING NO. 245.560
PAGE 1/1
ORDER NO.

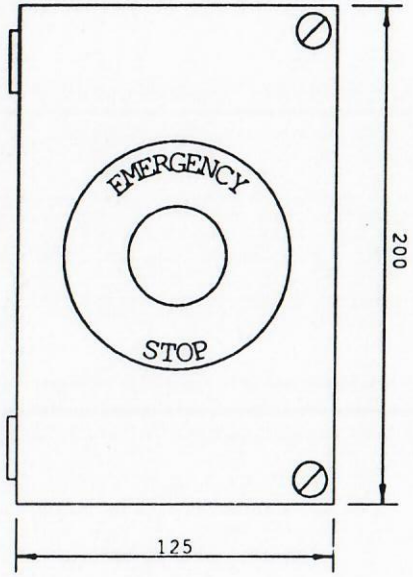
REV.NO. 0

PRODUCED BY VIW
ON 16/01/90 AT 13:39
DRAWING FILENAME T245560_0
PLOTTED AT SCALE 1/1

ARRANGEMENT



FRONT VIEW

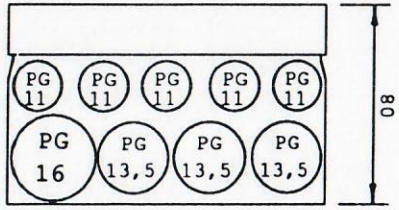


PART LIST

ITEM	COMPONENT	MANUFACTURE	TYPE	REMARK
3K18	RELAY	IZUMI	RH2BU AC+VOLTAGE	110V,220V, 240V
▲ 1 4K3	TIME RELAY	TELEMECANIQUE	RE1LA003	24V-240V AC 10-300SEC.
—	SOCKET	IZUMI	SH2B-05U	—
3S9	EMERGENCY STOP	IZUMI	AVW401-R	ø 40 MM
—	BOX	LODAM	—	—

(1) ONLY MOUNTED WHEN COMMON OIL RETURN IS INCLUDED

BOTTOM VIEW



ALSO SEE DRAWING NO. 245.559

REVISON:

SABROE
P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED: LSS 891211	CLIENT
DRAWN: CHN	
CHECKED:	CONTRACT
APPROVED:	
NF: X	

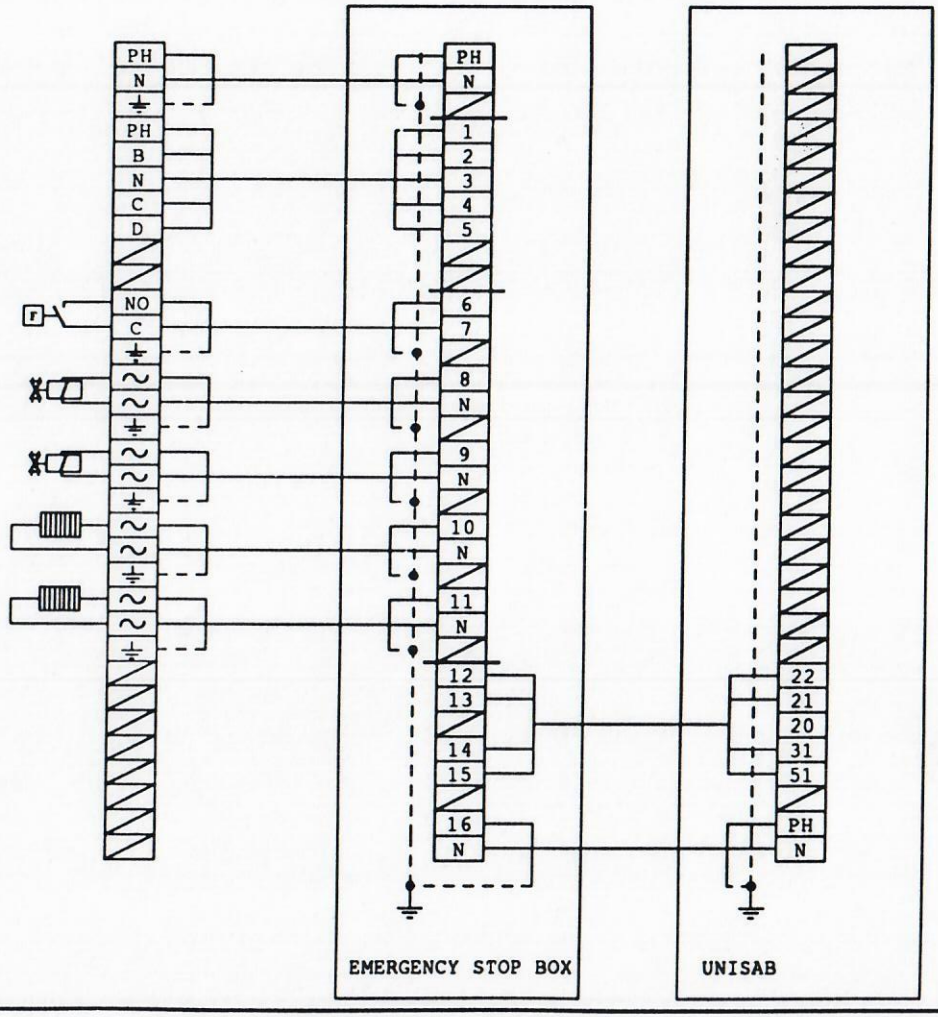
TITLE
EMERGENCY STOP BOX
FRONT VIEW, ARRANGEMENT AND PART LIST
UNISAB-CONTROL

DRAWING NO. 245.561
PAGE 1/4
ORDER NO.

REV.NO. 0

PRODUCED BY CHN ON 15/01/90 AT 16:48
DRAWING FILENAME T245561_0
PLOTTED AT SCALE 1/1

COMPONENT/UNIT						CABLE	EMERGENCY BOX	CABLE	UNISAB
SABROE POS.NR.	REMARK	NOTE	MAKE	TYPE	TERMINAL NO.		TERMINAL NO.		TERMINAL NO.
—	USER CONNECTION	POWER SUPPLY 115V AC OR 230V AC	—	—					
3A11	USER CONNECTION	COMPRESSOR MOTOR STARTER	—	—					
—	▲ OPTION	FLOAT SWITCH	—	—					
4Y6	—	SOLENOID VALVE OIL RETURN	—	—					
4Y8	—	SOLENOID VALVE WATER COOLING	—	—					
4E10	—	HEATING ELEMENT CRANK CASE HEATER SMC 112, SMC 116	—	—					
4E12	—	HEATING ELEMENT CRANK CASE HEATER	—	—					
3A2	—	START SIGNAL FROM UNISAB	—	—					
3A2	—	COMPRESSOR STARTER FEED BACK	—	—					
3A2	—	POWER SUPPLY TO UNISAB	—	—					



REVISION:

SABROE
P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED: LSS 891211
DRAWN: CHN
CHECKED:
APPROVED:
MF: X

CLIENT

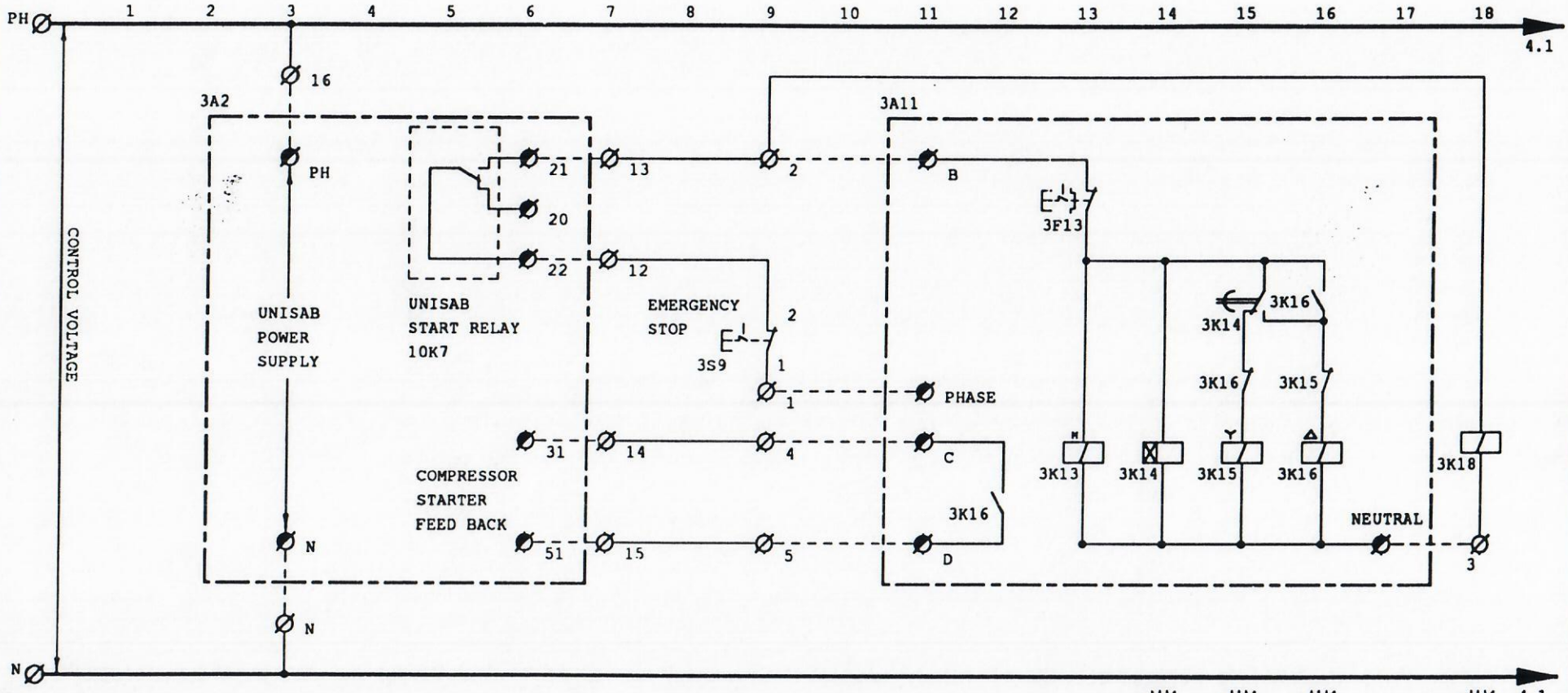
CONTRACT

TITLE
EMERGENCY STOP BOX
WIRING DIAGRAM
INPUT/OUTPUT
UNISAB-CONTROL

DRAWING NO. 245.561
PAGE 2/4
ORDER NO.

REV.NO. 0

PRODUCED BY CHN ON 15/01/90 AT 13:56
DRAWING FILENAME T245561_0
PLOTTED AT SCALE 1/1



SEE DRAWING NO. 245.559

UNISAB

NOT INCLUDED FROM SABROE

S/D STARTER COMPRESSOR MOTOR

REVISON:

SABROE
P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED:	LSS 891211
DRAWN:	CHN
CHECKED:	
APPROVED:	
MF:	X

CLIENT

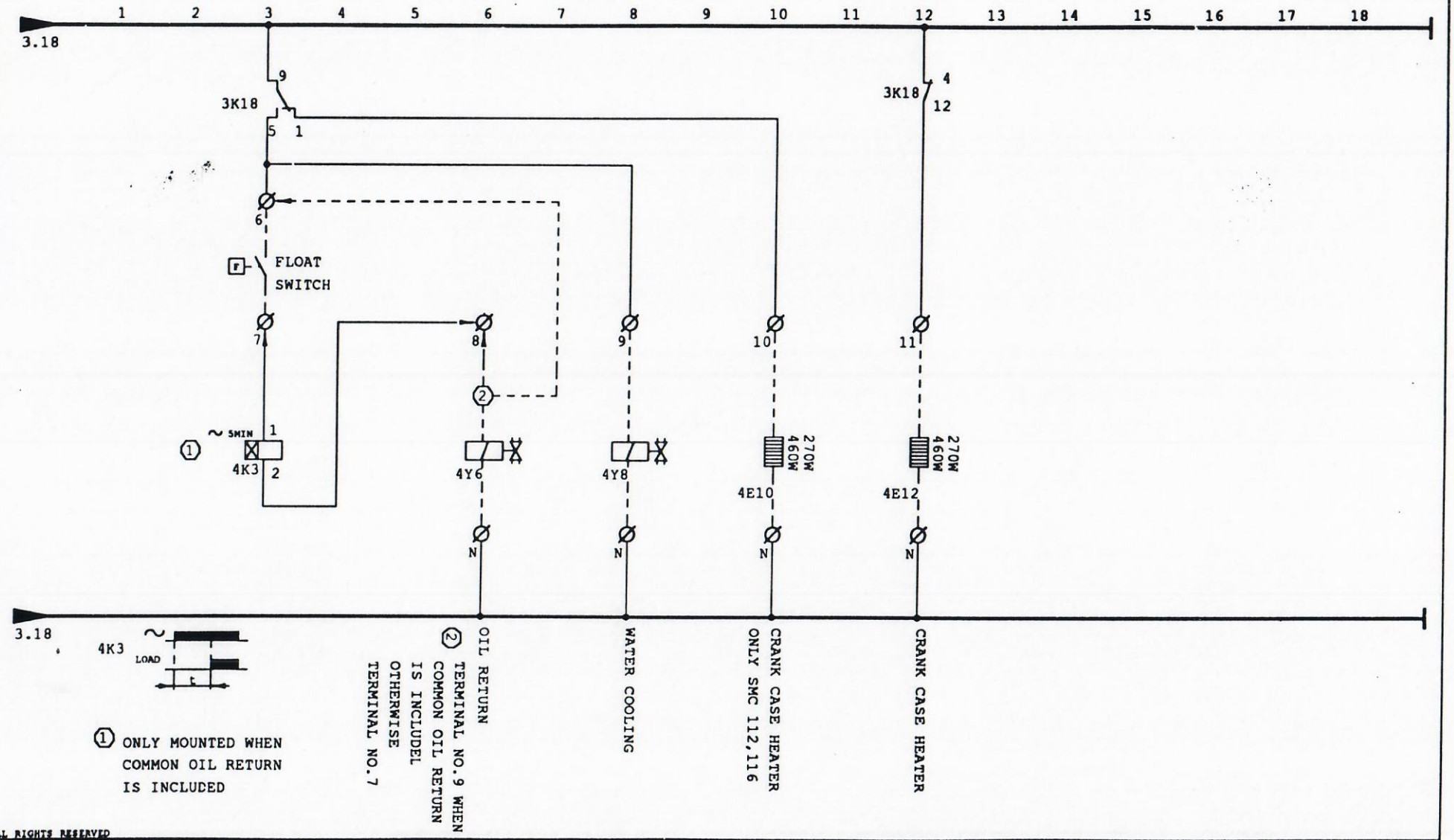
CONTRACT

TITLE
EMERGENCY STOP BOX
SCHEMATIC CONTROL DIAGRAM
UNISAB-S/D STARTER
UNISAB-CONTROL

DRAWING NO. 245.561
PAGE 3/4
ORDER NO.

REV.NO. 0

PRODUCED BY CHN ON 15/01/90 AT 13:56
DRAWING FILENAME T245561_0
PLOTTED AT SCALE 1/1



REVISON:

SABROE

P.O. BOX 1010, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED:	LSS 891211
DRAWN:	CHN
CHECKED:	
APPROVED:	
MF:	X

CLIENT

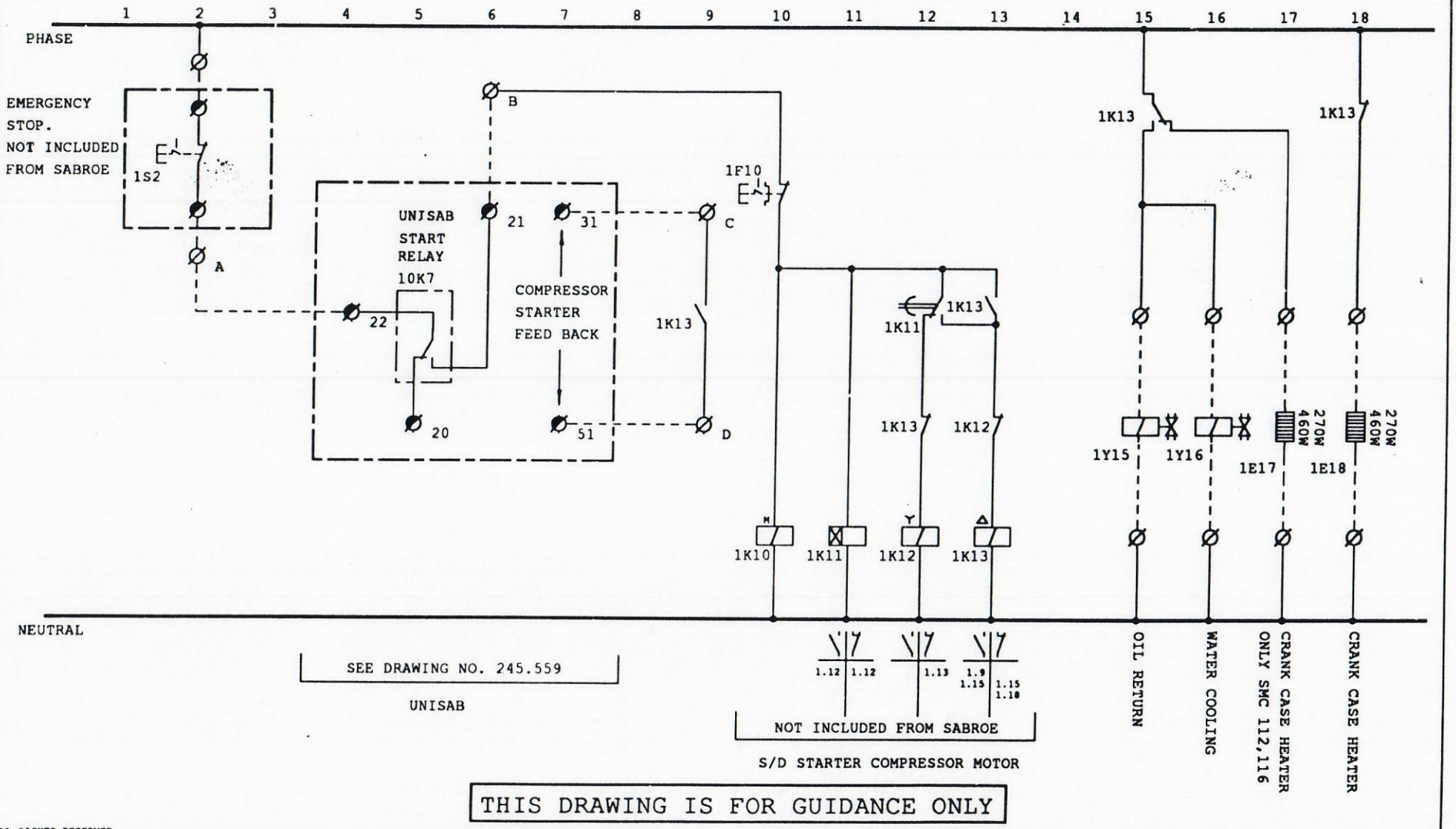
CONTRACT

TITLE
EMERGENCY STOP BOX
SCHEMATIC CONTROL DIAGRAM
SOLENOID VALVES-HEATERS
UNISAB-CONTROL

DRAWING NO. 245.561
PAGE 4/4
ORDER NO.

REV.NO. 0

PRODUCED BY CHN ON 15/01/90 AT 13:56
DRAWING FILENAME T245561_0
PLOTTED AT SCALE 1/1



THIS DRAWING IS FOR GUIDANCE ONLY

REVISON:

SABROE
P.O. BOX 1810, 8270 HØJBJERG, DENMARK
PHONE: (06)271266. TELEX: 68740 SABROE DK
CABLE: SABROE AARHUS

DESIGNED:	LSS 900103
DRAWN:	CHN
CHECKED:	
APPROVED:	M.F. X
CLIENT	
CONTRACT	
TITLE	S/D STARTER/EMERGENCY STOP COMPRESSOR MOTOR UNISAB-CONTROL
DRAWING NO.	245.562
PAGE	1/1
ORDER NO.	
REV.NO.	0

PRODUCED BY CHN ON 15/01/90 AT 13:51
DRAWING FILENAME T245562_0
PLOTTED AT SCALE 1/1

Replacing EPROM (program) in UNISAB-monitor og controller

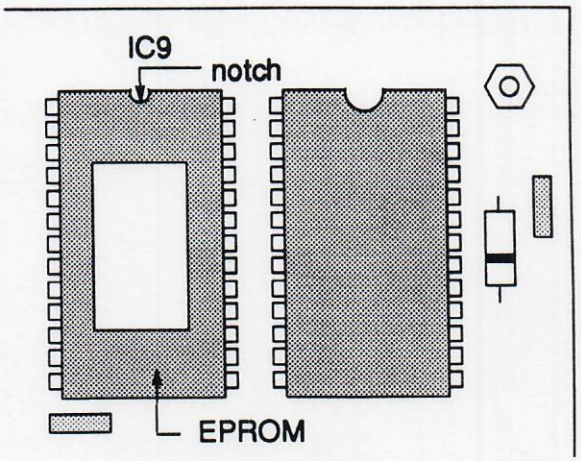
EPROM, a module which can be programmed, is fitted on a base in the micro-electronic part of the UNISAB.

Use the following procedure when replacing the EPROM, or transferring it to another UNISAB.

- Cut the power supply to the UNISAB.
- Disconnect the compressor motor starter and comply with all safety precautions stipulated in the instruction manual. Please also observe local safety regulations.
- Open the door and remove the cover plate inside by unscrewing the six slotted screws on the door.
- The EPROM module is positioned in the top right hand corner of the print plate (as illustrated).

The EPROM has a white label glued to its surface.

- Loosen the EPROM module from the base, using an approved PROM-extractor. Do not damage the pins on the module!



Use your fingers to position the new EPROM, as follows:

- The notch in the end of the EPROM (seen above) must point upwards towards the IC9 mark.
- Be very careful and make sure that all the pins are put into the base.
- Screw the cover plate on again, using the 6 slotted screws.
- Connect the power and the UNISAB is ready to function with the new EPROM (program).

UNISAB Control
External wiring

This instruction describes how the UNISAB control should be wired to external connections.

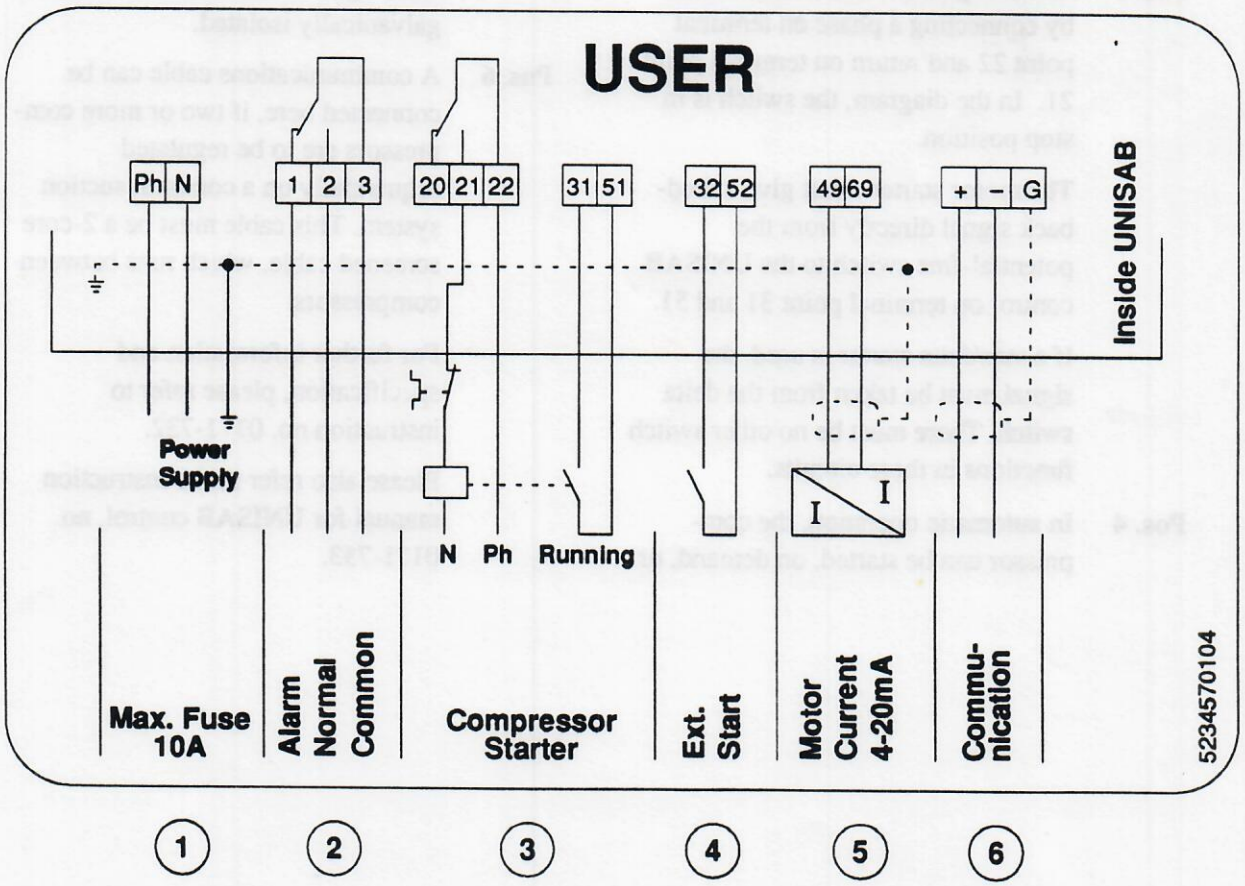
Important:

- UNISAB control may only be connected by authorised personnel and in accordance with local guidelines.
- Before connecting the UNISAB control, **disconnect** the compressor motor starter to prevent the compressor from starting accidentally.
- UNISAB control supplies all its inputs with 24 V/DC through an external **potential-free** switch, i.e. a switch which is not connected to anything else – as shown in the diagram.

NB: *Please note that if an* external power supply *is connected to the UNISAB control's input, the electronics will be damaged.*

Connection diagram

The following diagram, showing external connections, corresponds to the yellow label inside the door of the UNISAB control.



The following notes refer to the position numbers indicated in the drawing:

Pos. 1 The power supply must be connected to terminal points PH and N.
The earth must be connected to the earth bar.

Pos. 2 A potential-free switch, which can be used for a remote alarm.

When the UNISAB is powered and operating normally, the switch between terminal points 2 and 3 will be closed.

When an alarm occurs, the switch will change position to signal between terminal points 1 and 3. This also applies if the power supply is disconnected.

Pos. 3 The compressor starter is activated by connecting a phase on terminal point 22 and return on terminal point 21. In the diagram, the switch is in stop position.

The motor starter **must** give a feedback signal directly from the potential-free switch to the UNISAB control on terminal point 31 and 51.

If a star/delta starter is used, the signal must be taken from the delta switch. There must be no other switch functions in these circuits.

Pos. 4 In automatic operation, the compressor can be started, on demand, or stopped through a potential-free switch, connected on terminals 32 and 52. If the switch is connected, the compressor can start, if required. If the switch is opened whilst the compressor is in operation, it will stop immediately.

If this function is not required, short terminal points 32 and 52.

Pos. 5 The compressor motor current can be measured on this input. The input is 4-20 mA. The signal sent from the current transformer 0-1 Amp AC must therefore be converted to 4-20 mA DC.

The converter must **not** be fitted on the UNISAB control. It can, for example, be placed in the motor starter panel. The converter must be galvanically isolated.

Pos. 6 A communications cable can be connected here, if two or more compressors are to be regulated sequentially on a common suction system. This cable must be a 2-core screened cable, which runs between compressors.

For further information and specification, please refer to instruction no. 0171-732.

Please also refer to the instruction manual for UNISAB control, no. 0171-753.

MULTISAB sequential regulation of reciprocating and screw compressors on the same suction system

PROSAB and UNISAB have identical communication systems, which means that they can be coupled together and regulated in sequence. However certain guidelines must be followed.

- The electrical connections are explained in instruction no. 0171-732.

- If both screw and reciprocating compressors are to be included in the system, the sequence must be programmed in the following manner:
  1. Screw – screw ..... recip. – recip.
  2. Recip. – recip. ..... screw – screw

  The compressors must be programmed collectively. If the compressors are programmed haphazardly subsequent regulation will not be optimal.

  The compressors should always be labelled with a number to avoid confusion. If compressors get mixed up, the system will not function properly.

- To set the system up, please refer to the **MULTISAB** section in instruction no. 0171-729 describing the PROSAB, and the **MULTISAB** section in instruction no. 0171-753 which describes UNISAB control.

- Then code the start sequence into one of the PROSABs, using picture no. 5.1.4 for up to 7 compressors and picture no. 5.1.5. for 8 to 14 compressors. Follow the instructions given in the PROSAB instruction manual no. 0171-729.

  Note:
  The sequence can **only** be changed on the PROSAB.

- Using the PROSAB, it is also possible to distribute the compressors on two regulation systems, e.g. HP and LP as system 1 and system 2.

- Before the compressors can start, the **external start with instant stop** signal on the PROSAB must be given. Likewise the **external start** signal must be given on the UNISAB control. These signals can also be used to prevent the compressors from starting.

Example

Sequence: screw – screw – screw – recip. – recip.

If the reciprocating compressors are only required at week-ends, the **external start** signal to the screw compressors can be interrupted. The MULTISAB system will then only regulate the reciprocating compressors.

The sequence can also be altered to week-end operation:

Sequence: recip. – recip. – screw – screw – screw

The **External start** signal to the last two screw compressors can be interrupted. The first screw will then adopt a **stand-by** position for peak loads.

- The PROSABs/UNISABs can be coupled to a central computer for remote monitoring and control – please refer to instruction nos. 0171-760 and 0171-734.

Regulation

Example 1:

Sequence: screw – screw – screw – recip. – recip.

After start-up the screw compressors will start, distributing the load between the last two compressors until they are all running at 100% capacity. The reciprocating compressors will then be coupled in stage by stage until the cooling requirement is met.

Example 2:

Sequence: recip. – recip. – screw – screw – screw

When the system is started up, the reciprocating compressors will couple in, stage by stage. When they are operating at full capacity the first screw compressor will be started. The screw compressors will distribute the load on the last two compressors. If the system stabilizes with the first screw compressor operating at about 50% capacity, the reciprocating compressors will reduce capacity until the screw compressor capacity exceeds 85%.

The performance is higher when reciprocating compressors run on part load than when screw compressors run at low capacity.

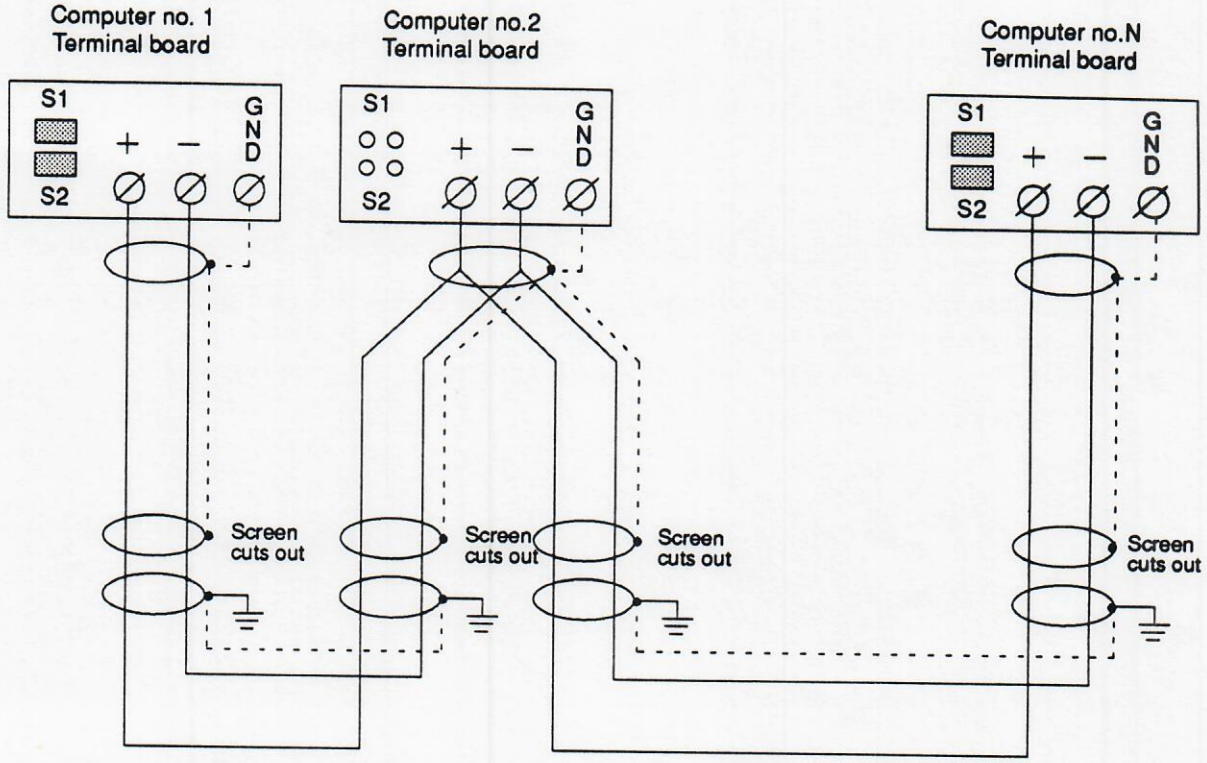
- If a screw compressor runs on part load, a reciprocating compressor will take the load up, provided it can cope with the extra capacity, and the screw compressor will be stopped.
- The system compensates for any compressor which falls out of the sequence due to an alarm or the current limit function.

  If a limit has been invoked because of high discharge pressure, no other compressors will be started up until the discharge pressure drops below the limit.

Installing a data communications cable

In order to ensure that data communication between several SABROE computers functions correctly, the communications cable must be connected as shown.

This guideline is only valid for PROSAB/ UNISAB installations which comply with RS485 standard.



Important

1. Make sure that the cables, including those inside the PROSAB box, are laid as far from other wires as possible.
2. The cable screen must be connected to the earth bar using as short a wire as possible.

The cable is terminated in the three screw terminals, which are marked as shown above.

The cable should be drawn in parallel from computer to computer – both cores and the screen.

Computer 1 and computer N must terminate the cable correctly, which is why the two "jumpers" S1 and S2 are fitted in the termination plugs.

S1 and S2 must **not** have jumpers fitted on any of the other computers.

The total length of the cable used must not exceed 1000 m.

The cable must be of the specified type, i.e.:

2–core data cable with screen

capacity core/core	**164 pF/m**
capacity core+core to screen	**312 pF/m**
DCR for core:	**49 Ohm/km**
DCR for screen:	**37 Ohm/km**

SABROE can supply the relevant type of cable.

NB: *DCR = Direct Current Resistance*

Connecting a PROSAB II/UNISAB Control to a Central Computer

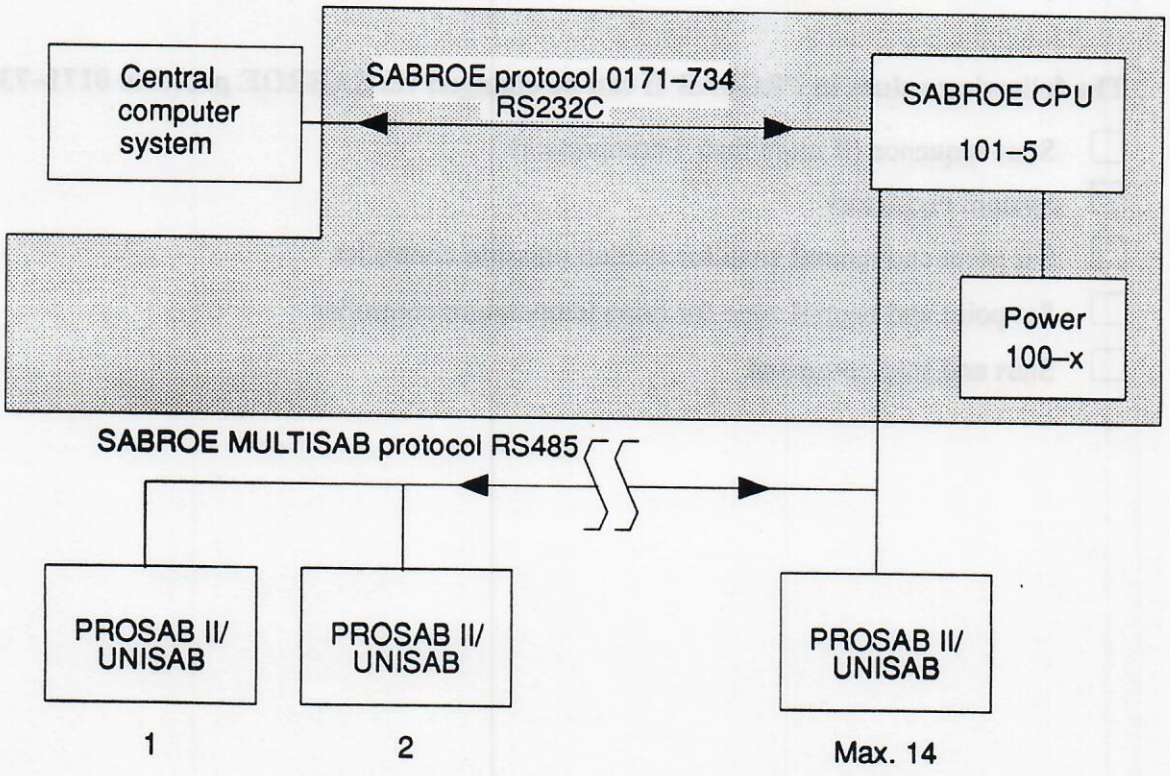
Provided each compressor is fitted with PROSAB II (screw compressors) or UNISAB Control (reciprocating compressors), several compressors can be linked by SABROE's MULTISAB program on a common system, which facilitates regulation and optimizes compressor operation. No extra equipment or software is necessary.

If a central computer is to be included in the MULTISAB network, SABROE can supply a power supply and software module. This equipment is indicated by shading in the diagram below and described in the following:

SABROE CPU 101–5 and power supply 100–x are supplied in a steel plate box ready to be fitted in the electric panel.

Central computers of any make can be coupled to the system and access data in the PROSAB II/UNISABs by means of a very simple link protocol (described in SABROE instruction no. 0171–734 for PROSAB II and 0171-760 for UNISAB).

The customer must program his computer to transfer data from the CPU 101–5 in accordance with the link protocol.



Equipment in the shaded area can also be supplied by SABROE.

The following values in PROSAB II can be read via SABROE protocol 0171–734

- ☐ Suction gas temperature
- ☐ Discharge gas temperature
- ☐ Oil temperature
- ☐ Suction pressure (Bar)
- ☐ Discharge pressure (Bar)
- ☐ Suction pressure (° C/Refrigerant)
- ☐ Discharge pressure (° C/Refrigerant)
- ☐ Capacity slide position
- ☐ Volume slide position
- ☐ Compressor motor current
- ☐ Universal input
- ☐ Oil filter differential pressure
- ☐ Suction gas superheat
- ☐ Running hours for compressor motor
- ☐ Set point for suction press. controller
- ☐ Set point for brine temp. controller
- ☐ Alarms
- ☐ Warnings
- ☐ Control mode (stopped, remote, automatic, manual)
- ☐ Compressor mode (stop, pre–lubricating, running etc.)
- ☐ Start sequence (if more than 1 compressor)

The following values in PROSAB II can be changed via SABROE protocol 0171–734:

- ☐ Start sequence (if more than 1 compressor)
- ☐ System regulators
- ☐ Set point and neutral zone for suction pressure controller
- ☐ Set point and neutral zone for brine temperature controller
- ☐ Start and stop command

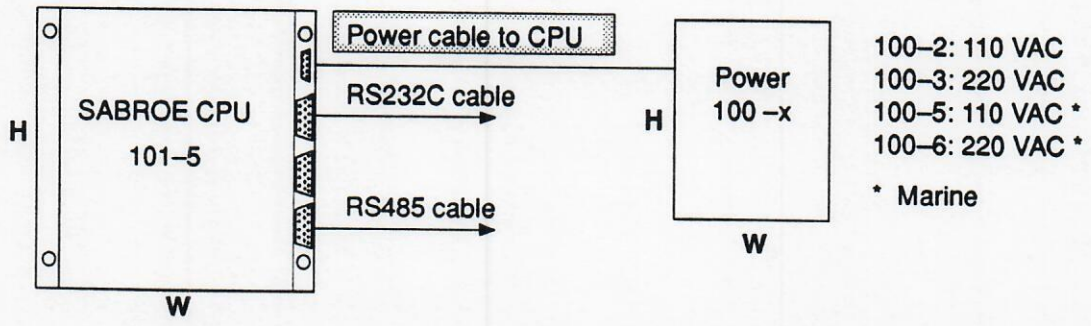
The following values in UNISAB Control can be read via SABROE protocol 0171–760

- ☐ Suction gas temperature
- ☐ Discharge gas temperature
- ☐ Oil temperature
- ☐ LP Discharge gas temperature
- ☐ Suction pressure (Bar)
- ☐ Discharge pressure (Bar)
- ☐ Oil pressure
- ☐ Intermediate pressure
- ☐ Suction pressure ($°C_{sat}$)
- ☐ Discharge pressure ($°C_{sat}$)
- ☐ Intermediate pressure ($°C_{sat}$)
- ☐ Compressor motor current
- ☐ Suction gas superheat
- ☐ Running hours for compressor motor
- ☐ Set point for suction press. controller
- ☐ Alarms
- ☐ Warnings
- ☐ Control mode (remote, manual)
- ☐ Compressor status (ready, running, stopped etc.)
- ☐ Start sequence (if more than one compressor)
- ☐ Compressor capacity

The following values in UNISAB Control can be changed via SABROE protocol 0171–760:

- ☐ Start sequence (if more than 1 compressor)
- ☐ System regulators
- ☐ Set point and neutral zone for suction pressure controller
- ☐ Set point for capacity regulator

Dimensions:



H x W x D = 340 x 290 x 60 mm

H x W x D = 200 x 150 x 120 mm

▒ Supplied by SABROE

SABROE Protocol 0171–760 for UNISAB Control

This instruction specifies how a central computer and a SABROE CPU 101–5, as described in instruction no. 0171–733 should communicate.

Hardware

Serial communication, standard RS232C

Plug connection must be:

Pin 2: Td receiver (transmitted data)
Pin 3: Rd transmitter (received data)
Pin 7: Gnd signal ground

Software

This protocol allows a central computer to retrieve data from a SABROE CPU. The SABROE computer will **always** wait until the central computer has started communication.

The communication message must always have the following format:

Stx – Code – Index – Point – Data – Etx
(11 characters)

Stx: Indicates the start of the message
Code: Indicates the type of command (read or write)
Index: Gives the number of the UNISAB which should receive the message
Point: Gives the number of the variable which should receive the message
Data: Gives the value of the variable to be read/written
Etx: Indicates the end of the message

Stx	02.	Indicates the start of the message (1 character)
Code	20h..21h	Indicates the type of command 20h = read data 21 h = write data (1 character)
Index	20h..7Eh	Gives the number of the UNISAB which should receive the message 20h = UNISAB no. 1 21h = UNISAB no. 2 etc. (1 character)
Point	20h..7Fh	States at which point in the variable list the command should be executed 20h = suction gas temp. 21h = discharge gas temp etc (1 character)
Data		The data field can contain values between –99.0 and +999.9 or 0 to 99999 (6 characters) When the code is "read data" the data field must be underscored field ------ (ASCII 5Fh) When the code is "write data" the data field must contain the value to be written
Etx	03.	Indicates the end of the message (1 character)

The reply from the SABROE CPU

The reply from the SABROE CPU will always be a copy of the message received, apart from the data field which may be altered.

The data field will be altered if the message received was a read command, or if there was a fault in the message.

The data field will be unaltered if the message received was a write command.

Error messages

This protocol gives an error message if the message received does not comply with the prescribed syntax.

Error messages will be shown in the data field in the reply message:

Data field:	_ _ _ _ _ _ –	No errors
	F _ _ _ _ 3	Code does not exist
	F _ _ _ _ 4	Index does not exist
	F _ _ _ _ 5	Point does not exist
	F _ _ _ _ 6 –	Read or write not possible
	F _ _ _ _ 7 –	UNISAB does not exist
	F _ _ _ _ 8 –	Compressor type mismatch
	F _ _ _ _ 9 –	Message not understood

If there is a parity error in the message, or if the number of characters received differs from 11, no reply message will be given.

Example 1:
Read the oil temperature from UNISAB no. 5

Message from central computer:

02h	20h	24h	22h	_ _ _ _ _ _	03h
Stx	Code	Index	Point	Data	Etx

Reply from SABROE computer:

02h	20h	24h	22h	_ _ 53.1	03h
Stx	Code	Index	Point	Data	Etx

This means that the oil temperature is +53.1 °C

Example 2:
Read the control mode in UNISAB no. 3

Message from central computer:

02h	20h	22h	32h	_ _ _ _ _ _	03h
Stx	Code	Index	Point	Data	Etx

Reply from SABROE computer:

02h	20h	22h	32h	_ _ _ _ _ 2	03h
Stx	Code	Index	Point	Data	Etx

This means that UNISAB no. 3 is in AUTOMATIC CONTROL.

Example 3:
Change set point for suction pressure in UNISAB no. 1

Message from central computer:

02h	21h	20h	21h	_–24.0	03h
Stx	Code	Index	Point	Data	Etx

Reply from SABROE computer:

02h	21h	20h	21h	_–24.0	03h
Stx	Code	Index	Point	Data	Etx

This means that UNISAB no. 1 now operates with a suction pressure set point of –24.0 $°C_{sat}$.

Table of points which can be read:

50h: Suction pressure (Bar)
51h: Discharge pressure (Bar)
52h: Oil pressure (Bar)
53h: Intermediate pressure (Bar)
54h: Suction temperature
55h: Discharge temperature
56h: Oil temperature
57h: Intermediate temperature
58h: Motor current
59h: Suction pressure ($°C_{sat}$)
5Ah: Discharge pressure ($°C_{sat}$)
5Bh: Intermediate pressure ($°C_{sat}$)
5Ch: Superheat
5Dh: No. of hours in operation
5Eh: Set point ($°C_{sat}$)

5Fh: Neutral zone ($°C_{sat}$)
60h: Alarm no. 1
61h: Alarm no. 2
62h: Alarm no. 3
63h: Alarm no. 4
64h: Alarm no. 5
65h: Warning no. 1
66h: Warning no. 2
67h: Warning no. 3
68h: Warning no. 4
69h: Warning no. 5
6Ah: Control mode
6Bh: Compressor mode
6Ch: Start no. in sequence
6Dh: System no. 1 regulator
6Eh: System no. 2 regulator
6Fh: System no.
70h: Capacity (%)

All measured values are returned with 1 decimal (pressure, temperature).

Table of points which can be written:

50h: Start no. in sequence
51h: Suction system
52h: System no. 1 regulator
53h: System no. 2 regulator
54h: Set point ($°C_{sat}$)
55h: Neutral zone ($°C_{sat}$)
56h: Capacity set point code

Table of capacity set point codes:

Code 0: Disable capacity control
Code 10: Cap.control : Motor off
Code 11: Cap.control : Motor on (only with add. unloading)
Code 12: Cap.control : 1st capacity step
Code 13: Cap.control : 2nd capacity step
Code 14: Cap.control : 3rd capacity step
Code 15: Cap.control : 4th capacity step
Code 16: Cap.control : 5th capacity step
Code 17: Cap.control : 6th capacity step
Code 18: Cap.control : 7th capacity step

Table of compressor control modes:

Control mode 0: "NOT USED"
Control mode 1: "MANUAL CONTROL"
Control mode 2: "LOCAL AUTOMATIC"
Control mode 3: "REMOTE CONTROL"

Table of compressor modes:

Mode 1: "READY"
Mode 2: "RUNNING"
Mode 3: "STARTING"
Mode 4: "SHUTDOWN"
Mode 5: "PAUSE"
Mode 6: "NOT USED"
Mode 7: "NOT USED"
Mode 8: "RUNNING – OVERLOAD"
Mode 9: "RUNNING – PRESSURE LIMITATION"
Mode 10: "STOPPED"

Table of alarms/warnings:

Id	Name	Alarm	Warning
31	Low suction pressure	x	x
32	Low discharge pressure	x	x
33	Low oil pressure	x	x
34	Low intermediate pressure	x	x
35	Low superheat	x	x
36	Low discharge temperature	x	x
37	Low oil temperature	x	x
38	Low intermediate temp.	x	x
39	High discharge press.	x	x
40	High oil pressure	x	x
41	High intermediate press.	x	x
42	High superheat	x	x
43	High discharge temp.	x	x
44	High oil temperature	x	x
45	High intermediate temp.	x	x
46	High motor current		x
47	Thermistor	x	
48	No feedback	x	
49	System error	x	