PFAFF
Electronic Stop

QD55x / QE55x

Series: digital K2

$C\epsilon$

Type

P40K2

Instruction Manual

Part 2

Valid as from revised software 4A_006_0.HEX)

The $C\epsilon$ symbol confirms that the respective drive system meets the requirements for partial machines of the following EU directives:
- **EMV Directive 89/336/EWG**
- **Low Voltage Directive 73/23/EWG**

Contents

Technical updatings reserved!

7. Description of the Drive System
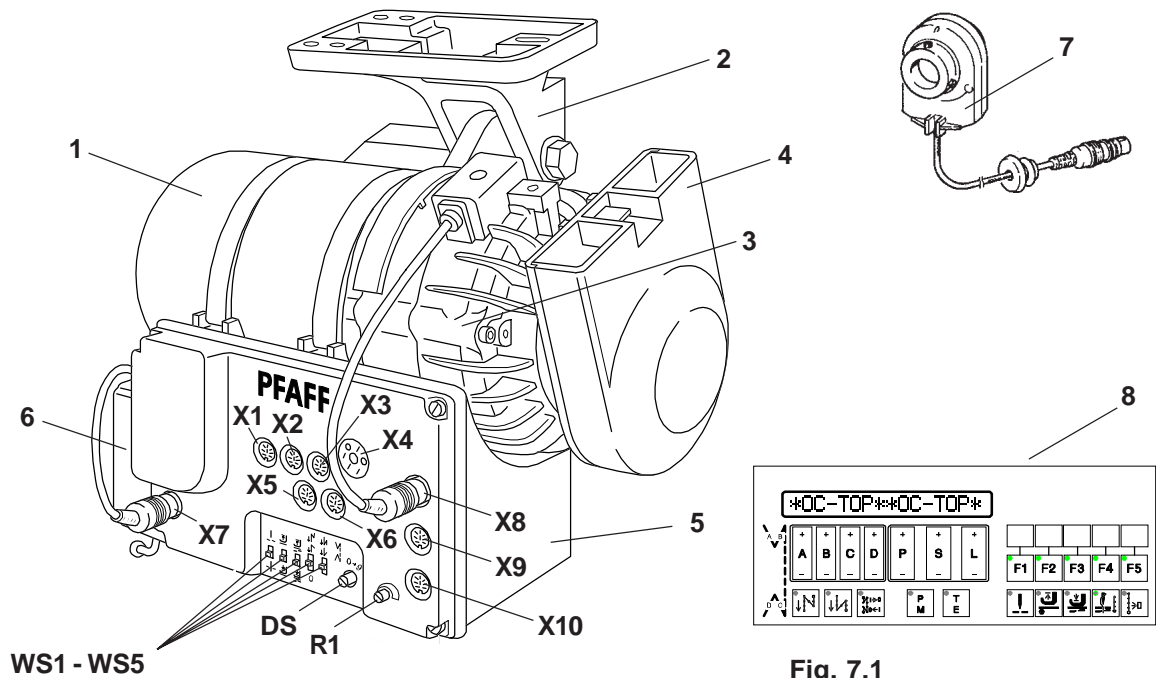
Fig. 7.1

The Quick Electronic Stop drive system digital K2 comprises the following main assemblies (see Fig. 7.1):

- Basic motor 1 (asynchronous motor with mounting base 2, solenoid friction clutch/brake unit 3 and belt guard 4)
- Control system 5
- Speed control unit 6 (command unit)
- Synchronizer 7 (position control unit)
- Operator panel 8 (optional)

7.1 Basic Motor (QD55x, QE55x)

The basic motor is an asynchronous motor with flange-mounted solenoid-controlled friction clutch and brake unit. The motor is equipped with a terminal box for connection to mains power (mains voltage) and for connection of the control system to power supply. The rated power of the motor (power at output shaft P_2) is 550 Watt in operating mode S6.

The clutch and brake unit is connected to the front of the control box by means of a 4-lead cable with a 4-contact plug to be inserted into the socket identified by the appropriate symbol (X8).

7.1.1 Procedure for Checking and Adjusting the Clutch Clearance

a) Switch the motor off, pull the mains plug out, and wait for the motor to come to complete stop.

b) Take the belt off the belt pulley.

c) Remove fan hood (1) by turning counter-clockwise.

d) Hold the ventilator (2) immobile, and turn belt pulley (10) manually.
   If the belt pulley cannot be turned, this means that there is no air gap between the clutch disk (5) and the flange (7).

e) Loosen the three clamp screws (13) until the belt pulley begins to be turning while the ventilator is held immobile.

f) Insert adjustment clip (21) into the bores (8) provided on the ventilator (2). Exert pressure on the adjustment clip (21) and simultaneously turn the ventilator until the adjustment clip snaps into the bores (9) on the adjustment screw (4).

g) Turn ventilator (2) - with adjustment clip (21) snapped into the adjustment screw (4)- counter-clockwise about one full turn.

h) Retighten the three clamp screws (13).

i) Turn ventilator (2) - with adjustment clip (21) snapped into the adjustment screw (4) - clockwise until belt pulley (10) can barely be turned.

j) Turn ventilator (2) - with adjustment clip (21) snapped into the adjustment screw (4) - counter-clockwise by approx. 120 degrees (120 degrees = distance between two capnuts (11) on the end bell). After this procedure, the air gap will be approx. 0.5 mm.

k) Remove adjustment clip (21), place fan hood (1) back into position and tighten by turning clockwise.
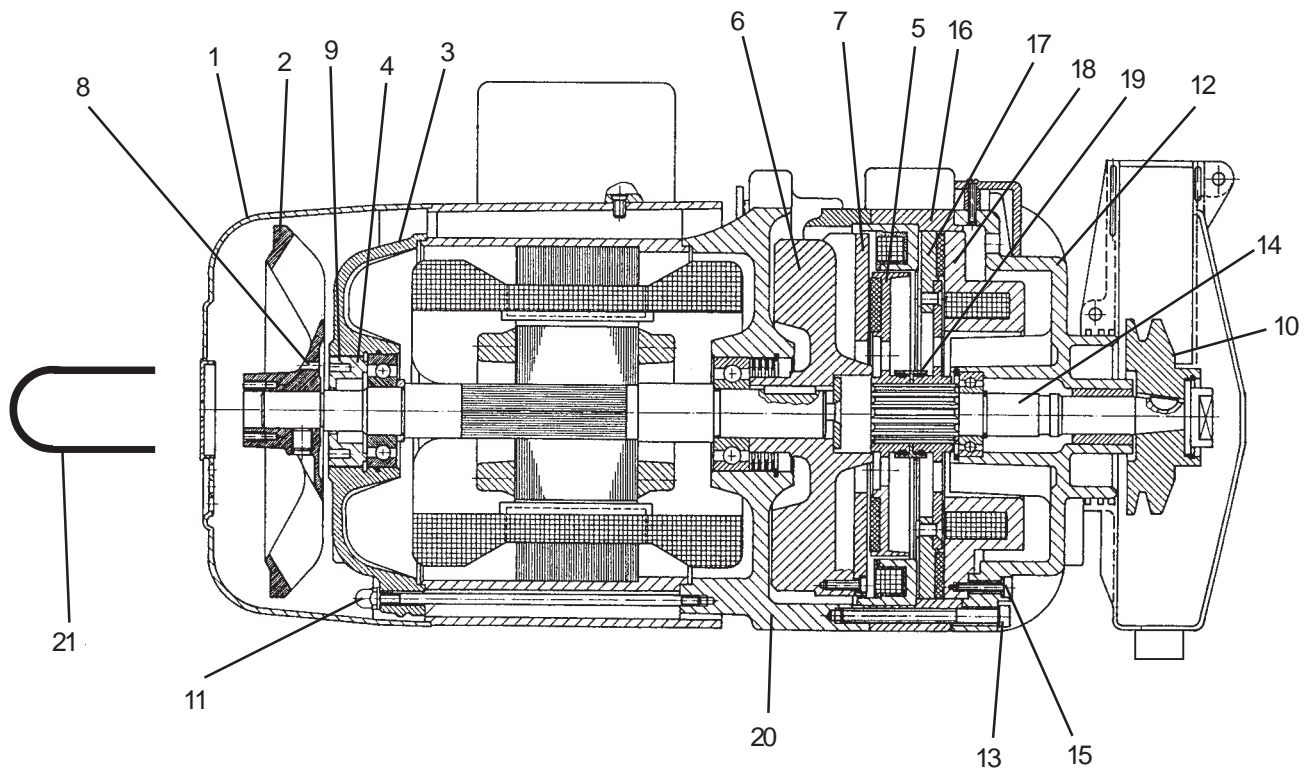
Fig. 7.2

7.1.2 Procedure for Replacing of Clutch

a) Switch the motor off, pull the mains plug out, and wait for the motor to come to complete stop.

b) Take the belt off the belt pulley (10).

c) Remove the belt pulley from the shaft.

d) Pull the plug out of socket X8 on the control box.

e) Remove the three screws (13) and pull end bell (12) with clutch/brake assembly off the A end bell (20) of the motor.

f) Check and clean flange (7).
   If the flange shows wear grooves, replace this part.

g) Before placing the new clutch/brake unit, check that the dust washer (not shown in the figure) is securely seated in the central bore of flange (7).

h) Place the new clutch/brake unit on to the A end bell (20) of the motor and fasten by means of the three screws (13)

i) Mount the belt pulley.
   Put the belt in place and insert the connecting plug of the clutch/brake unit into socket X8 on the control box.

7.1.3 Procedure for Replacing the Clutch and Brake Disk

a) Proceed as described under 7.1.2, Steps a) through g).

b) Slide clutch disk (5) off the gearing on the output shaft (14).

c) Separate clutch solenoid body (16) from end bell (12) so as to allow brake disk (17) to be removed from the gearing on output shaft (14).

d) Clean the brake face of brake solenoid body (18).

e) Clean the gearing on output shaft (14) and slide new brake disk (17) on.

f) Slide stop washer (19) with its grease-filled side onto the brake disk hub.

g) Slide new clutch disk (5) onto the gearing of output shaft (14) and press stop washer (19) in.

h) Slide clutch solenoid body (16) onto end bell (12). Make sure that the plug on the end bell is correctly inserted into the socket on the clutch solenoid body.

i) Place the clutch/brake unit on to the A end bell (20) of the motor and fasten by means of the three screws (13)

j) Mount the belt pulley.
   Put the belt in place and insert the connecting plug of the clutch/brake unit into socket X8 on the control box.

7.2 Control System - Control Box

The control box is mechanically attached to the motor casing by means of two retaining straps. The control system includes two fuses (800 mA slow-action), the power supply transformer, the circuit board with power supply unit and the electronic control and data processing systems. This circuit board is accommodated behind the cover closing the box at the front.
Power supply for the control system is derived from the motor terminal box.

The control system **P40K2** comprises

sockets   X1 to X6 for connection of process elements (keys, switches, solenoids, solenoid valves)
             X7   for the speed control unit (command unit)
             X8   for the clutch and brake
             X9   for the synchronizer (position control unit)
             X10 for an operator panel

selectors WS1 for the needle position at sewing stop (down, up)
             WS2 for the presser foot position at sewing stop (down, up)
             WS3 for the presser foot position at end of seam (down, up)
             WS4 for front backtack (none, single, double)
             WS5 for end backtack (none, single, double)

potentiometer   R1   for continuous reduction of the maximum machine speed preset by parameter <607>.

rotary switch   DS for programming the backtack stitchcount and the needle positions NPx

inputs (Ex) for connecting keys, switches, proximity switches, monitors etc.

      E1:   feed reverse (manual backtack)
      E2:   needle position change-over   if <616> = I [1]
              needle up without trimming   if <616> = II
      E3:   single stich   if <617> = I
              backtack function changeover if <617> = II
      E4:   stop/start lock   if <624> = I
              presser foot   if <624> = II

  [1]   <616> = I means that the value of parameter 616 is set to „I"
      <616> = II means that the value of parameter 616 is set to „II".

outputs (Ax) for connecting solenoids, solenoid valves, signal transmitters etc.

      A1:   thread trimmer pneumatic
      A2:   thread trimmer magnetic
      A3:   thread wiper
      A4:   presser foot lift
      A5:   Feed reverse
      A7:   presser foot descent
      A8:   motor running

Electrically, these outputs are distributed over sockets X1 through X6 (for details see chapter 12. Connections Diagram Plug Board)

7.3 Speed Control Unit (Command Unit)

As a general rule, this unit is attached to the lefthand side of the control box by means of two screws and is mechanically connected by means of a pitman rod with the treadle located on the sewing machine stand.

Electrical connection is made by inserting the cable with 7-contact plug into the correspondingly marked female connector (X7) located on the lefthand front face of the control box.

The speed control unit is a mecano-electric converter, dividing the treadle stroke into 16 different digital values comprising 4 bits each.

To achieve this, the speed control unit is equipped with 4 signal tracks (A, B, C, D).

The 16 digital values are listed below together with the treadle stroke (treadle position) and with the uppertaining command.

Coding Chart of the Speed Control Unit:

Position:	Outputs:				
	A	B	C	D	
-2	0	1	1	0	Treadle heeled fully (seam end, SN)
-1	0	1	1	1	Treadle heeled slightly (PF lift)
0	1	1	1	1	Treadle zero position
+1	1	1	1	0	Treadle toed slightly (PF down)
+2	1	1	0	0	Speed step 1
+3	1	1	0	1	Speed step 2
+4	1	0	0	1	Speed step 3
+5	1	0	0	0	Speed step 4
+6	1	0	1	0	Speed step 5
+7	1	0	1	1	Speed step 6
+8	0	0	1	1	Speed step 7
+9	0	0	1	0	Speed step 8
+10	0	0	0	0	Speed step 9
+11	0	0	0	1	Speed step 10
+12	0	1	0	1	Speed step 11
+13	0	1	0	0	Speed step 12 (n-max treadle toed fully)

7.4 Synchronizer (Position Control Unit)

This unit is mechanically attached to the machine handwheel and is connected with the righthand front face of the control box by inserting a cable with a 6-contact plug into the female connector (X9) marked with the synchronizer symbol.

The synchronizer is a mechano-electric transducer (angular position transmitter) comprising a transmitter disk equipped with a signal track and a synchronization track. Signal generation is performed by photoelectric means via light barriers.

The signal track furnishes 480 pulses per revolution on two channels (FA, FB). The two pulse sequences are electrically phase-shifted by 90 degrees and thus permit recognition of the direction of rotation. The synchronization track furnishes one pulse per revolution having a width of 240 pulses furnished by the signal track.

⚠ The synchronizer is a precision instrument. To prevent malfunction, please do not open the unit!

Synchronization of the drive system and the machine is made with the synchronizer by a teach-in process within user programming (zero adjustment of the machine).

7.5 External Operator Panel OC-TOP
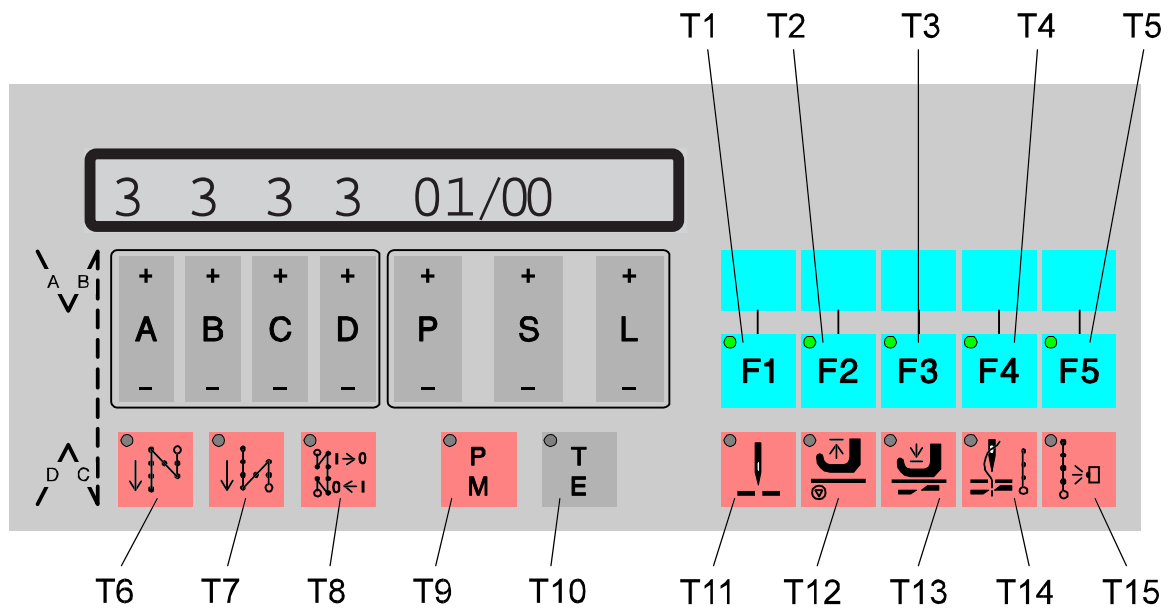
Fig. 7.3

The operator panel OC-TOP (Fig. 7.3) has the following components:

- a display: 16-digit LCD matrix

- 14 programming keys:
  A+ / A-, B+ / B-, C+ / C-, D+ / D-, P+ / P-, S+ / S-, L+ / L-

- 2 keys for operating mode selection:
  T9 (P/M)   for change-over between programmed or manual sewing
  T10 (T/E)   for change-over between programming or sewing

- 8 keys with specified functional contents:
  T6   for front backtack (on/off)
  T7   for end beacktack (of/off)
  T8   for backtack inversion
  T11   for needle position at sewing stop (up/down)
  T12   for presser foot position at sewing stop (up/down)
  T13   for presser foot position after seam end (up/down)
  T14   for thread trimming (on/off)
  T15   for sewing with light barrier (on/off)

- 5 keys (T1 ... T5) with their functional signification being specified by the control program (control software)
  Meaning of keys T1 to T4 if key T5 is not pressed (dark):
  T1 (F1)   for linking seam sections (with/without)
  T2 (F2)   for speed control
                  constant (automatic) or
                  variable (treadle-controlled)
  T3 (F3)   feed reverse for a seam section
  T4 (F4)   seam section manual or stitchcounted or single stitch (<440>)
  Meaning of keys T1 to T4 if key T5 is pressed (bright):
  T1   currently no function
  T2   currently no function
  T3   currently no function
  T4   unit count in display or single stitch (<440>)

- outlet for two light barriers on the rear of the OC-TOP

The keys T1 ... T15 are provided with one signal lamp each (LED). Each LED provides optical feedback on the control position of the function assigned to each key. If the function is ON, the LED is bright; if the function is OFF, the LED is dark.

8. Application

The digital K2 drive model **X40K2** can be used **either with** or **without an external operator's control panel** (OCP).

The following external operator's control panels can be used:

- **OCP B2**
- **OCP OC-TOP**

8.1 Sewing without an Operator's Control Panel

When working with the X40K2 <u>without</u> operator's control panel, the function selectors WS1 to WS5 on the control box front are active, and sewing can only be performed manually.

The following functions can be called up via these switches:

WS1:   Needle position (up/down) when stopping before seam end

WS2:   Presser foot position (up/down) when stopping before seam end

WS3:   Presser foot position (up/down) after seam end

WS4:   Initial backtack: without / single / double

WS5:   End backtack: without / single / double.

The backtack stitchcount (1 to 9) is defined by the position of the rotary switch (DS) (see fig. 7.1).

8.2 Sewing with Operator's Control Panel B2
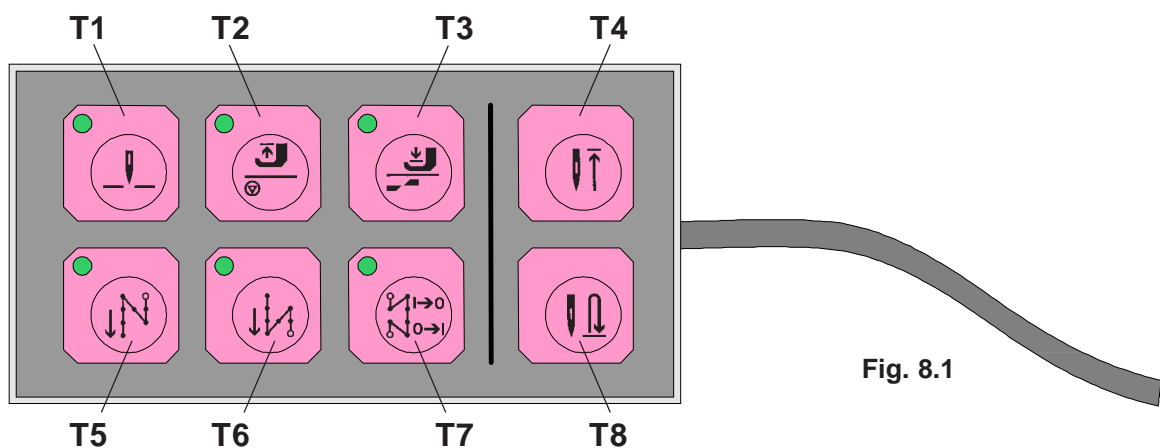
Fig. 8.1

If the digital K2 is used with the OCP B2, then only the manual sewing work option is available.

The following functions can be called up via the keys of the OCP B2:

T1:   Needle position when the machine stopped before end of the seam
up: (LED switched on)
down: (LED switched off)

T2:   Position of the presser foot when the machine is stopped before the end of the seam
up: (LED switched on)
down: (LED switched off)

T3: Position of the presser foot after the end of the seam
up: (LED switched on)
down: (LED switched off)

T4: Needle up without trimming

T5: Initial backtack
on: (LED switched on)
off: (LED switched off)

T6: End backtack
on: (LED switched on)
off: (LED switched off)

T7: Backtack inversion or elimination
If this key is pressed (LED switched on), before the start of the seam length, then from the start of the seam length the opposite function to what is indicated on key T5 will be effected.

If this key is pressed during sewing (LED switched on) then the opposite function to what is indicated on key T6 will be effected at the end of the seam length.

T8: Single stitch
When this key is pressed, the machine will perform one extra stitch.

The actual position of each function is indicated by the LEDs which are built into each key.

The type of backtack - single or double - will be chosen by the selector switches WS4 and WS5 at the front of the control box.

The other function selecting switches (WS1, WS2, WS3) at the front of the control box are without effect.

Indication of defective functions at the OCP B2:

Functions that are inoperative or defective in the drive or only in the control box will be indicated via the LEDs in the keys.

There are two signal positions which indicate these malfunctions:

a) The upper three LEDs and the lower three LEDs are blinking alternately; this means that the malfunction is within the scope of error codes < 63 (for details see chapter 8.4).

b) All six LEDs are blinking at the same time; this means that the malfunction is within the scope of error codes > 64 (for details see chapter 8.4).

8.3 Sewing with External Operator's Control Panel OC-TOP

8.3.1 Sewing without Sewing Program (manual Sewing)

Condition: key T9 (P/M) is dark
                    key T10 (T/E) is dark

Display showing
  - before start or after start, when <605> = II

```
┌─────────────────────────────┐
│  3   3   3   3   0x /00      │
└─────────────────────────────┘
```

        rated backtack stitchcount

    sewing program activated when

  key T9 (P/M) is pressed (bright)
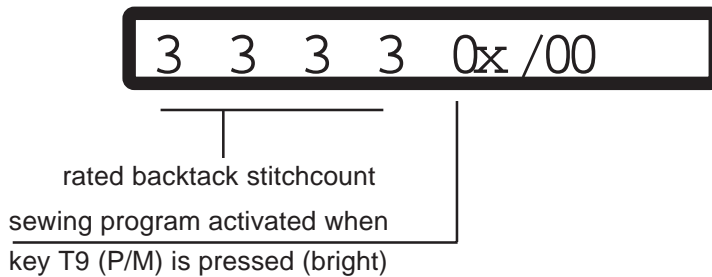
Setting of rated backtack stitchcount is possible only with the machine at standstill
for front backtack forward with   key A+ or
                                          key A-,
for front backtack backward with   key B+ or
                                          key B-,
for end backtack backward with   key C+ or
                                          key C-,
for end backtack forward with   key D+ or
                                          key D-.

Display showing
  - before start, when <605> = I

```
┌─────────────────────────────┐
│  4 160✱        0x/00         │
└─────────────────────────────┘
```

            actual speed

        symbol for actual

        speed
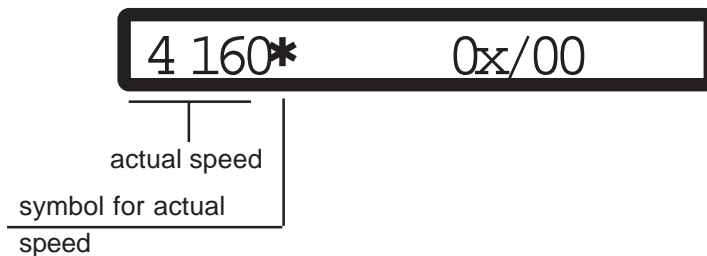
8.3.2 Sewing with Sewing Program

Condition: key T9 (P/M) is bright
                    key T10 (T/E) is dark

Display showing before start if no seam section has been activated

```
┌─────────────────────────────┐
│  3600   00  0 1/00      2    │
└─────────────────────────────┘
```

            rated speed

        subsequent sewig
        program

        sewing program

        seam section (00 = before start)

        cycles (sequences of program)
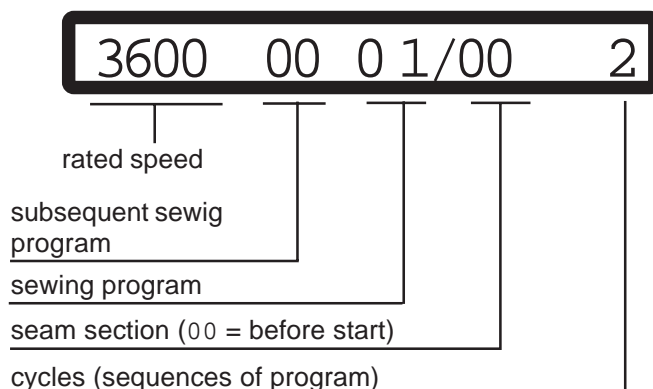
When this is displayed, the following can be modified:

- program: by actuating key P+ or P-

- seam section: by actuating key S+ or S-

- cycles: by actuating key L+ or L-

- the subsequent sewing program via key D+ or D-

- rated speed for the program: by actuating key A+ or A-
  This speed is limited by parameter <221>

Display before start if a seam section has been activated

```
4  4  4  4  01 /01   25
```

backtack stitchcount
in sewing program

sewing program

seam section
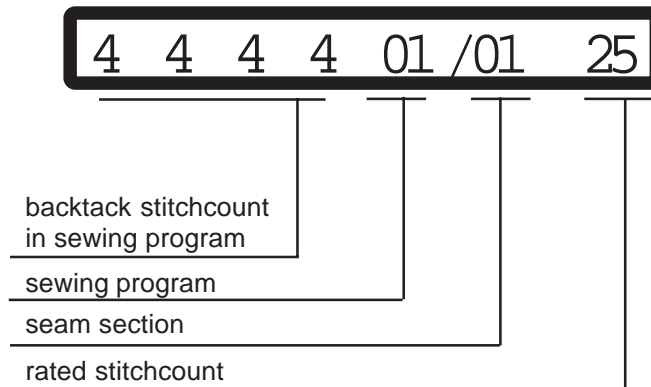
rated stitchcount

When this is displayed, the following can be modified:

- the preset backtack stitchcount for the program by actuating the keys located below the respective digits

- rated stitchcount of a seam section: by actuating key L+ or L-

- program: by actuating key P+ or P-

- seam section: by actuating key S+ or S-

Display showing after start, when <605> = II

```
4  4  4  4  01 /01   25
```

rated stitchcount

Display showing after start, when <605> = I

```
3580*       0 1/0 1  25
```

actual speed

symbol for actual
speed
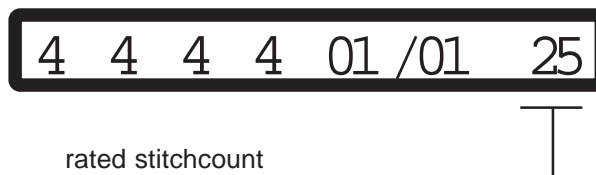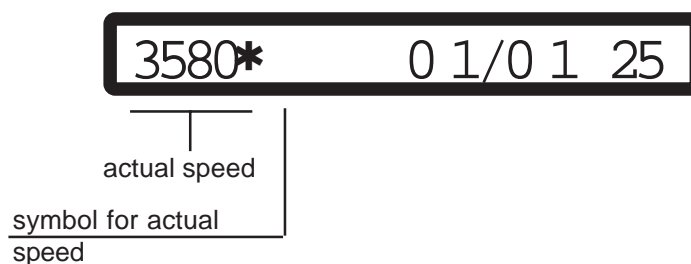
Sewing programs

a) 5 sewing programs can be used

b) The sewing programs comprise up to 5 seam sections

c) Each seam section can comprise up to 99 stitches

d) The following functions can be assigned to each seam section:
   front backtack   via key T6
   end backtack   via key T7
   needle position at sewing stop   via key T11
   presser foot position at sewing stop   via key T12
   presser foot position after completion via key T13
   of seam section
   thread trimming   via key T14
   feed reverse   via key T3

e) Linking consecutive seam sections can be made via key T1

f) Sewing speed can be chosen to be either constant (automatic) or variable (treadle-controlled) via key T2.

g) The stitchcount of a seam section can be interrupted via treadle position -2. This condition is signalled by the letter M schown in the display. Manual sewing (without stitchcount) is now possible until the seam section is completed by renewed treadle position -2 and the program advancing to the subsequent seam section.

h) Seam sections can also be performed without stitchcount; stitchcount deactivation is made via key T4

i) In sewing with light barrier control, the rated stitchcounts stored for the seam section are light barrier compensation stitches.

j) The programs can be used as backtack/darn programs
   Change-over is made via parameter <313>
   Only seam sections 1 and 2 are activated respectively. The cycle counter defines the number of backtack operations performed (single, double, triple, four times ...)
   If the cycle counter is set to "zero", the program operates as darning program. Seam end is initiated via treadle position -2.

k) It is possible to run several sewing programs consecutively.
   During programming, the subsequent program is displayed by digits 6 and 7 and can be entered via key D+ and D-.
   00 means that the current program will be performed exclusively; at its end return is made to its start.

8.4 Error Messages (Malfunction Diagnostics)

The control system of the drive cyclically tests its own functional condition and the functional condition of the complete drive system.

Malfunctions are signalled via the display of the external operator panel, for instance:

```
┌──────────────────────────────────┐
│                  ERROR  7 1      │
└──────────────────────────────────┘
```

List of possible error codes:

1   Treadle not in zero position when mains power is turned ON
9   Start lock
10   Machine class, <799> was changed; remedy: turn mains power switch OFF and ON again
62   Short circuit on 24 V (32 V) DC
63   Overload on 24 V (32 V) DC, load current > 4 amps
64   Power supply monitor: voltage too low (90 V - 150 V)
65   Power electronics not operational after mains power ON, mains power < 130 V
66   Earth short (motor or motor supply line has earth short in one or more phases)
67   Internal malfunction
68   Power electronics shut-off
          a) Overcurrent, short circuit in motor or supply line
          b) Overvoltage, mains voltage too high (>300 V), motor overloaded while decelerating
          c) Undervoltage
69   Synchronizer not furnishing increments
          a) Synchronizer plug not inserted
          b) Belt not in place or belt tension insufficient
70   Machine blocked, no increment from synchronizer at max. motor torque
71   Commutation transmitter plug not inserted
72   Synchronizer plugged into commutation transmitter connector
73   Motor overloaded
75   Internal malfunction
90   EEPROM does not exist
91   EEPROM not programmable
92   Start lock while motor running
93   Wrong EEPROM

100 ⎤
      ⎬ Internal malfunction
117 ⎦

In case of error messages ≥ 62, the motor will stop in undefined positions.

Control system reset possible only by mains power OFF/ON.

9. Programming by the User

Enables machine functions and parameters to be switched on or set up.

User programming of the **digital K2** can be carried out via

- external operator's control panel OC-TOP

The user programming of the **digital K2** is possible by means of an external operator's control panel OC-TOP via:

- direct programming and/or

- programming parameters.

The programming of parameters is possible via three levels of program:

- Programming on level A (operator level)

- Programming on level B (technician's level)

- Programming on level C (special level)

9.1 User Programming with Operator Panel OC-TOP
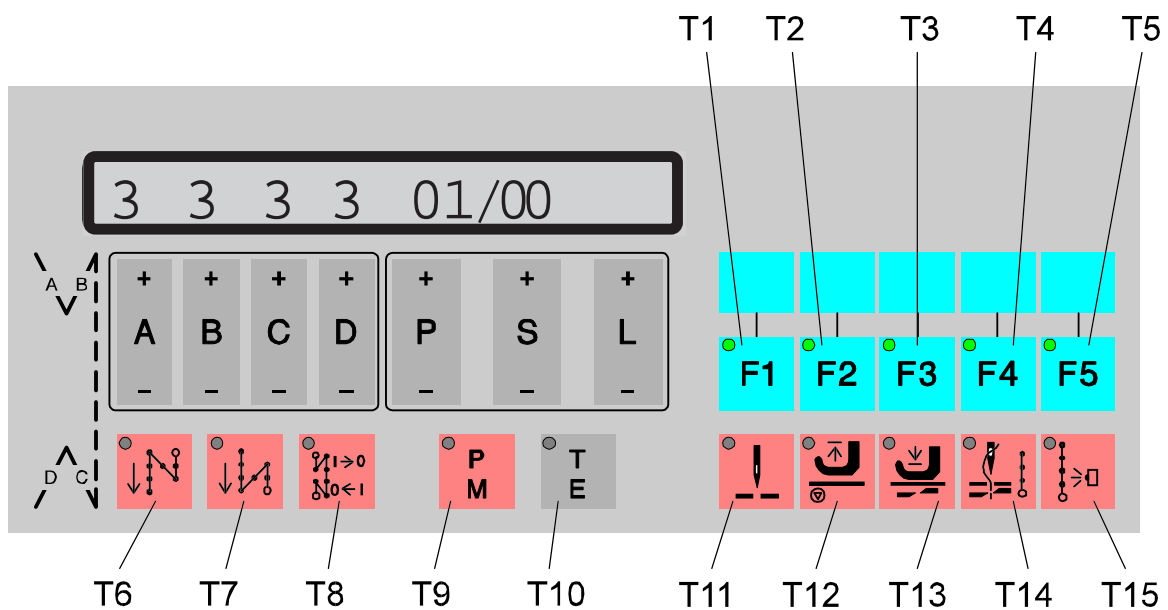
Fig. 9.1

9.1.1 Direct Programming

Attention! All values modified within direct programming are stored only when
a) the drive system is started or
b) key T9 (P/M) are pressed.
If the drive system is switched off via the mains power switch immediately after any values were modified, the values set before modification will be retained!

Regardless of the programming levels, certain values can be programmed without calling up parameter numbers - i.e. directly.

The follwoing values can be modified by direct programming:

Front backtack stitchcount forward
Front backtack stitchcount backward
End backtack stitchcount backward
End backtack stitchcount forward
Stitchcounts for seam sections
Speeds for seam sections
Functions for seam sections

a) Modification of backtack stitchcounts

Display shown when "manual sewing" is ON (T9 (P/M) and T10 (T/E) not luminous)

```
3  3  3  3  0x/00
```

Display shown when "programmed sewing" is ON (T9 (P/M) luminous, T10 (T/E) not luminous)

```
4  4  3  3  0x /01   25
```

The symbolic seam pictogram on the lefthand side of the operator panel shows the backtack sections

A: Front backtack forward
B: Front backtack backward
C: End backtack   backward
D: End backtack   forward

Immediatedly below the display, there are keys
A+/A- for backtack section A,
B+/B- for backtack section B,
D+/C- for backtack section C,
D+/D- for backtack section D

These keys permit to increase or decrease the backtack stitchcounts.

b) Programming of the Stitchcount for a Seam Section

Condition: Operation mode „programmed sewing" is on, i.e. key T9 (P/M) is bright and key T10 (T/E) is dark, machine not sewing

Display showing

```
3  3  3  3  01 /01   25
```

backtack stitchcount
in sewing program

sewing program

seam section

rated stitchcount of seam section
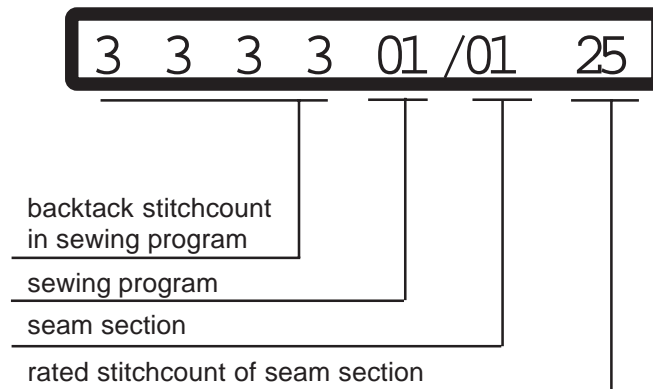
Activation of a <u>sewing program</u> is made via keys P+ or P-

Activation of a <u>seam section</u> is made via keys S+ or S-

Programming of the <u>stitchcount</u> for the seam section is made via key L+ (value increased) or L- (value decreased)

c) Programming of Seam Sections by „Teach-in" (Performing Work)

Condition: Key T9 (P/M) is bright
Key T10 (T/E) is bright

The machine must have performed at least one stitch before.

Activate the desired program in the display via keys P+ or P- and the seam section to be programmed via keys S+ or S-.

Cycle:
 a) Treadle forward
    Reaction: the stitchcount which has been registered up to now will be eliminated
 b) Treadle returns to zero position
 c) Treadle forward
    Reaction: machine sews, the sewed stitches will be added in, shown in the display and registered

Correction of the value shown in the display is possible via key L+ or L-.

d) Programming of Cycles (Number of Sequences of Program), of Program Speed and of the subsequent Program

Condition: Operation mode „programmed sewing" is on, i.e. key T9 (P/M) is bright and key T10 (T/E) is dark, machine not sewing

Display showing

```
3600  00   01/00     2
```

rated speed

subsequent sewig
program
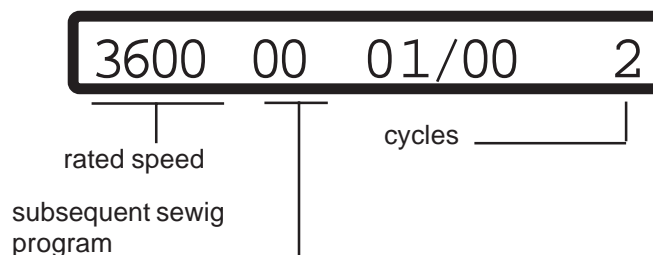
cycles

<u>Cycle</u> programming is made via the keys L+ (number increased) or L- (number decreased)

Programming of the <u>speed</u> for the program is made via key A+ (value increased) or A- (value decreased) This speed is limited by parameter <221>

Programming of the <u>subsequent sewing program</u> is made via keys D+ or D-.

e) Programming of Functions

Functions for the seam sections are controlled via the functional keys

T6   Front backtack or start stitch condensation (with/without)
T7   End backtack or end stitch condensation (with/without)
T11   Needle position at sewing stop and at the end of a seam section (up/down)
T12   Presser foot position at sewing stop (up/down)
T13   Presser foot position at the end of a seam section (up/down)
T14   Thread trimming at the end of a seam section (with/without)
T15   Sewing with light barrier (with/without)
T1   Linking of seam section (with/without), if T5 is dark
T2   Speed control, if T5 is dark
      variable (treadle-controlled, T2 is dark) or
      constant (automatic, T2 is bright)
T3   Transport reverse or stitch condensation of a seam section, if T5 is dark
T4   Seam section manual or stitchcounted, if T5 is dark

9.1.2 Parameter Programming

9.1.2.1 Programming Level A (Operator Level)

This level is used for programming control parameters which immediately affect the operation sequence.

These are the parameters for the following functions:

  - Front backtack (double or single)   <148>
  - End backtack (double or single)   <149>
  - Backtack (standard backtack or decorative backtack)   <523>
  - Light barrier compensation stitches   <111>
  - Light barrier fade-out   <112>
  - Softstart   <116>

a) Activation of Programming Level A

Conditions:
Mains power switch ON
Drive system not running
Operating mode: manual sewing must be ON (key T9 (P/M) dark)

$$\boxed{3 \quad 3 \quad 3 \quad 3 \quad 0x/00 \qquad 2}$$

Press key T10 (T/E)

Response:
Key T10 (T/E) becomes bright, the display shows in its righthand half the first parameter (parameter no. and parameter value) associated with programming level A.
Sewing is not possible

$$\boxed{3 \quad 3 \quad 3 \quad 3 \qquad 1 \quad 1 \quad 1 \qquad 6}$$

- Programming
  The Parameter number is set by using keys P+ or P- (hundreds of parameter no.) and keys S+ or S- (tens and units of parameter no.). The parameter value is programmed by using key L+ or L-

b) Deactivation of the Programming Level A

Press key T10 (T/E)

Respose:
Key T10 (T/E) goes dark, the display returns to initial condition.
Sewing is possible.

```
3  3  3  3    0x/00
```

9.1.2.2 Programming Level B (Technician Level)

This level is used for programming the control parameters which have to be modified or adapted very rarely or only for starting operation of the system.

a) Preparation for activation of the programming level B

Turn mains power switch OFF
Press and hold keys T9 (P/M) and T10 (T/E) simultaneously
Turn mains power switch ON
Release keys

Response:
The display shows a „✱" between program and seam section.
Sewing is possible.

```
3  3  3  3    0x✱00
```

b) Activation of programming level B

Press key T9 (P/M) (not becoming bright) and press key T10 (T/E) (becoming bright)

Response:
In the righthand half of the display are shown: a parameter number (at first 104, then the number selected last) and the associated value.
Sewing is not possible.

```
3  3  3  3    104    8
```

Modification of parameter number:
for hundreds of parameter numbers use key P+ or P-
for tens and units of parameter numbers use key S+ or S-

Modification of parameter value: via key L+ or L-

c) Deactivation of progrmming level B

Press key T10 (T/E) (not becoming bright)

Response:
Parameters shown disappear from the display, the display returns to initial condition
Sewing is posssible.

```
 3  3  3  3     0x*00
```

9.1.2.3 Programming Level C (Special Level)

At this level, control parameters are stored the values of which have to be modified in exceptional cases only. Correction of these parameters should therefore be made only after consultation of the manufacturer.

Activation of programming level C

 a) Activate programming level B (see 9.1.2.2)

 b) Call up parameter 798

 c) Set parameter value <798> to I

 d) Deactivate programming level B

 e) Turn mains power switch OFF, wait for >2 secs. to elapse

 f) Turn mains power switch back ON

 g) Press key T10 (T/E) (becoming bright)

Response:
In the righthand half of the display appears the first parameter of programming level C.

Calling up further parameter numbers and correcting the parameter values can be made in the same way as described for programming levels A and B.

Deactivation of programming level C:

 -   Press key T10 (T/E) (not becoming bright)

 -   Turn mains power switch OFF

9.1.3 Reset

All parameter values having been modified from the ex-factory condition (standard value) are reset to their standard values by this procedure.

Exceptions: parameters 700 and 799
                  For these parameters, the values programmed by the user are retained even after -
                  Reset- has been performed.

-Reset- procedure:

 - turn mains power switch OFF

 - press treadle fully forward and hold in that position

 - press and hold keys P- or P+, S- or S+ and L- or L+ simultaneously

- turn mains power switch ON

- relese the three keys and the treadle

Response: Display showing

```
RESET   Y -- N
```

Now -Reset- can be performed.
Located below the disply Y (yes) there is key P+. Press this key P+ to start the reset. The display briefly shows:

```
MASTER-RESET
```

After that the display shows the power-on display for approx. 2 secs.

```
P40K2      4 A_006_0
```

and then shows the display corresponding to the operating mode selected

```
3  3  3  3  0x/00
```

If it is not desired to start the -Reset-, press key L+ located below the display saying N (no).

9.2 User Programming without Operator Panel

To a limited extent, programming of the control system is also possible without an operator panel. This is done by means of internal miniature switches (S1a, S1b, S1c and S1d) and of the programming switch (S2) accommodated on the control circuit board. The switches (S1a, S1b, S1c, S1d) are accessible when the front cover of the control box is removed.

9.2.1 Needle Positions (angular adjustment)
(Procedure for Checking and Adjusting Needle Positions NPx)

Turn switch S1a on
Use rotary switch DS (S2) to select the different needle positions (NPx, angles):

Switch Position	Meaning
1	NP0: zero/reference position of the needle, <700>
2	NP1: needle down <702>
3	NP2: thread takeup lever up, <703>
4	NP5: end of trimming signal 1, <705>
5	NP6: start of trimming signal 2, <706>

Toe the treadle to open the programming mode. Turn the handwheel to correct (modify) the positions. Store the last position setting by advancing switch S2 or by turning S1a off.
For needle positions 5 (end of trimming signal 1) and 6 (start of trimming signal 2), the position settings can also be stored by heeling the treadle. This will cause the machine to run into NP2.
Heeling the treadle once more will cause the machine to make a full revolution with a trimming process being performed.
This can be repeated and thus permits easy checking of the trimming process.

9.2.2 Maximum Speed (<607>)

- Turn switches S1a and S1b on.

- Toe treadle fully and hold in that position.
  Response: speed is at first reduced to 500 rpm and is then increased in 300 ms intervals by 100 rpm increments.

- Finalize the adjustment and store the value obtained by leaving the treadle end position.

- This can be repeated by toeing the treadle again into its end position.

9.2.3 Standstill Brake (Residual Brake <718>)

Turn switch S1d on; this enables the standstill brake at the fixed value <718>.

The standstill brake can be disabled by turning switch S1d off.

9.2.4 Reset

- Switch the drive system off.

- Turn switch S1a on

- Toe the treadle to its end position and switch the drive system on.
  Result: all parameter values have been reset to their standard values (initial values), with the exception of NP0 (<700>).

10. Start of Operation

If the digital K2 has been stored at a temperature of <+5°C, then a working temperature of between +5°C and +40°C must first be obtained. The equipment must be dry.

Before work with the machine can be started, make sure to perform the following:

a) Control the direction of rotation

b) Adjust the reference position of the needle bar

c) Control the needle positions

d) Control the maximum speed

10.1 Start of the Operation without the Operator's Control Panel

10.1.1 Procedure for Checking the Direction of Rotation and for the correct Adjustment of the Needle Bar (Reference Position NP0)
(see also 9.2.1)

a) Switch machine ON and actuate treadle briefly forward.
Response: machine starts running briefly

b) Is the direction of rotation correct?
If yes, proceed to adjust the zero position, continue with c)
If no, switch the drive system off, pull the mains plug out, and change two connections in the motor terminal box.
For QDx, interchange connections L1 and L2;
for QEx, move capacitor lead from contact 1 to contact 3.
After that, continue with a)

c) Remove front cover of the control box, turn miniature switch S1a ON; turn rotary switch DS into position 1

d) Actuate treadle briefly forward
Response: machine makes one full revolution and positions at random.

e) Adjust the zero position of the needle bar by turning the machine handwheel in the direction of rotation until the needle tip on its way down reaches the needle plate level (reference position).

f) Toe treadle briefly
Response: machine makes a full revolution and positions in the same position that has been adjusted manually before

g) The reference position is stored when either S1a is switched OFF or rotary switch DS is turned to a different position.

10.1.2 Control of the Needle Positions (NP1 / NP2)
(see also 9.2.1)

NP1 - needle down position <702>
NP2 - thread take up lever in the up position <703>

a) Remove front cover of the control box, turn miniature switch S1a ON; turn rotary switch DS into position 2

b) Actuate treadle briefly forward
Response: machine starts and positions in position 1

c) Is the needle position correct?
When yes, then proceed as with f) below.
When no, then the position must be changed by turning the handwheel

d) Actuate the treadle briefly forward
    Reaction: The machine performs a revolution and positions in the same position.

e) The position can again be corrected.
    When no further correction is needed, then proceed as with f) below.

f) The selected needle position is stored when either S1a is switched OFF or rotary switch DS is turned to a different position.

g) Remove front cover of the control box, turn miniature switch S1a ON; turn rotary switch DS into position 3

h) Actuate treadle briefly forward
    Response: machine starts and positions in position 2

i) Is the needle position correct?
    When yes, then proceed as with f) below.
    When no, then the position must be changed by turning the handwheel

j) Actuate the treadle briefly forward
    Reaction: The machine performs a revolution and positions in the same position.

k) The position can again be corrected.
    When no further correction is needed, then proceed as with f) below.

10.1.3 Control of the Positioning (Angle) for Thread Trimming (NP5 / NP6) (see also 9.2.1)

NP5 - end of trimming signal 1 (<705>)
NP6 - start of trimming signal 2 (<706>)

a) Remove front cover of the control box, turn miniature switch S1a ON; turn rotary switch DS into position 4

b) Actuate treadle briefly forward
    Response: machine starts and positions in position 5

c) Is the needle position correct?
    When yes, then proceed as with f) below.
    When no, then the position must be changed by turning the handwheel

d) Actuate the treadle briefly forward
    Reaction: The machine performs a revolution and positions in the same position.

e) The position can again be corrected.
    If no further correction is needed, then proceed as f) below.

f) The selected needle position is stored when either S1a is switched OFF or rotary switch DS is turned to a different position.

g) Remove front cover of the control box, turn miniature switch S1a ON; turn rotary switch DS into position 5

h) Actuate treadle briefly forward
    Response: machine starts and positions in position 6

i) Is the needle position correct?
    When yes, then proceed as with f) below.
    When no, then the position must be changed by turning the handwheel

j) Actuate the treadle briefly forward
    Reaction: The machine performs a revolution and positions in the same position.

k) The position can again be corrected.
    If no further correction is needed, then proceed as f) below.

For needle positions 5 (end of trimming signal 1) and 6 (start of trimming signal 2), the position settings can also be stored by heeling the treadle. This will cause the machine to run into NP2.
Heeling the treadle once more will cause the machine to make a full revolution with a trimming process being performed.
This can be repeated and thus permits easy checking of the trimming process.

10.2 Start of the operation with operator's control panel OC-TOP

10.2.1 Procedure for checking the direction of rotation and for the correct adjustment of the needle bar (reference position NP0)

    a) Activate programming level B (technician level) (see section 9.1.2.2 „programming level B")

    b) Set parameter 700

    c) Actuate treadle briefly forward:
       Reaction: The machine performs a full revolution and then positions in a random position.

    d) Is the direction of rotation correct?
       When yes, then proceed to adjust the reference position, proceed with e) below
       If not, then switch off the drive, remove the wall plug and exchange the connections in the motor connection box.
       With QDx types exchange connections L1 and L2,
       with QEx types remove the capacitor connection from contact 1 and connect it to contact 3.
       Then continue with a)

    e) To adjust the zero position of the needle bar:
       Turn the handwheel of the machine in the direction of rotation until the point of the needle coming from up to down touches the level of the throat plate (= reference position).
       When doing this it is important that parameter <701> = I.

    f) Actuate the treadle briefly forward:
       Reaction: The machine performs one revolution and positions in the same position that had been previously obtained by hand.

    g) As soon as new parameter numbers are activated, or the programming level B is negated, then the parameter value <700> is memorized and the reference position adjustment is completed.

10.2.2 Control of the needle positions (NP1 / NP2 / NP3)

NP1 - needle down position <702>
NP2 - thread take up lever in the up position <703>
NP3 - needle up <710>

a) Activate programming level B (technician level) (see section 9.1.2.2 „programming level B")

b) Activate parameter 702

c) Actuate the treadle briefly forward
Reaction: The machine performs a revolution and then positions at the programmed <702>.

d) Is the needle position correct?
When yes, then proceed as with g) below.
When no, then the position must be changed
by turning the hand wheel (when <701> = I) or
via key L+ or L- (when <701> = II)

e) Actuate the treadle briefly forward
Reaction: The machine performs a revolution and positions in the same position.

f) The position can again be corrected.
When no further correction is needed, then proceed as with g) below.

g) As soon as another parameter number is called up, e.g. example 703, the previously programmed
value of <702> is memorized.

h) With parameter 703 and 710 correction is obtained as described above for parameter 702.

i) Deactivate programming level B (see section 9.1.2.2 „programming level B").

10.2.3 Control of the positioning (angle) for thread trimming (NP5 / NP6)

NP5 - end of trimming signal 1 (<705>)
NP6 - start of trimming signal 2 (<706>)

a) Activate programming level B (technician level) (see section 9.1.2.2 „programming level B")

b) Set parameter 705

c) Actuate the treadle briefly forward
Reaction: The machine performs a revolution and positions at the indicated <705>.

d) Is the position correct?
When yes, then proceed as g) below.
When no, then the position must be corrected
by turning the hand wheel (when <701> = I) or
via keys L+ or L- (when <701> = II).

e) Activate the treadle forward.
Reaction: The machine performs a revolution and positions at the corrected program value <705>.

f) The position can again be corrected.
If no further correction is needed, then proceed as g) below.

g) Back heel the treadle.
Reaction: The machine rotates to NP2, <705> is memorized, programming (correction of position)
is no longer possible.

h) If the treadle is back heeled then the thread trim procedure will be activated and the machine
performs one revolution.

i) Should parameter <705> be changed again, then the sequence from c) above must be repeated. In any other event, call up parameter 706 and repeat the sequence from c) above.

j) Deactivate program level B (see section 9.1.2.2 „programming level B").

10.3 Procedure for Checking the Maximum Speed

The maximum speed that can be achieved by the machine is derived from the following equation:

$$n_{Masch} = \frac{\varnothing S_{Mot}}{\varnothing S_{Masch}} \times n_{Mot}$$

wherein:

n_{Masch} = machine speed [rpm] (operating speed)

n_{Mot} = rated motor speed [rpm] as per motor nameplate specification

$\varnothing S_{Masch}$ = machine pulley diameter [mm]

$\varnothing S_{Mot}$ = motor pulley diameter [mm]

For manual sewing, the operating speed of the machine is determined by parameter <607>.

The reduction ratio between motor and machine has been chosen correctly when, with the treadle toed to its end position, the speed on the clutch shaft corresponds to the rated motor speed (see section 6.3). This is the case when increasing the value of parameter <607> further will not result in any further increase of the machine speed.

Attention: As to speed reduction by means of the potentiometer R1 on the control box, note the following:
Speed should only temporarily be reduced via the potentiometer R1. Permanent speed reduction should neither be made via the potentiometer R1 nor via parameter <607> so as to avoid excessive wear on the clutch. For permanent speed reduction, change the motor belt pulley!

10.4 Hardware Test

Hardware Test is a check routine permitting to use the operator panel OC-TOP for testing various components of the drive system (control system) and of the machine installation.

Hardware testing is made via seven test blocks. These are called up consecutively via key A+ or A-.

Activation of the „hardware test" routine

a) Activate programming level „B" and call up parameter 797

b) Set <797> to I

c) Deactivate programming level „B"

d) Turn mains power switch OFF

e) Wait for approx. 2 secs. to elapse, and turn mains power switch back ON

Response: The display shows „HARDWARE TEST" for approx. 2 secs.

After that, the display shows the first test block: Inputs.
All OC-TOP keys equipped with LEDs become bright

Survey of test blocks:

| Test Block	Check	Display
1	Inputs	`E01    0   X1:5`
2	Outputs	`A02    0   X2:4`
3	Speed control unit	`SWG    0`
4	Synchronizer	`IWG    000  0`
5	Potentiometer	`R1     xxx%`
6	Selectors	`WS1    0`
7	Rotary switch/ Miniature switch	`DS / MS      00000000`

To call up the test blocks (advancing from test block to test block), use keys A+ and A-.

To call up various functional elements within a test block (advancing from functional element to functional element), use keys B+ and B-.

To activate functional elements selected, use key D+

Test block 1: Inputs
Display:

```
E01    0   X1:5
```

          Pin no.

          Connecting plug

          State of input

          Input no.
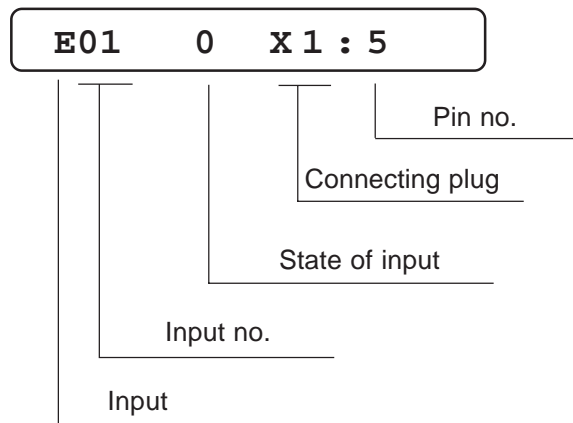
          Input

The function assigned to the input displayed can be seen from chapter 12 „Connections Diagram for Connectors".

The designations E (for input) are located on the lefthand side of the connectors shown.
The keys or selectors assigned to the inputs are designated S in the connections diagram and have the same numbers as the associated inputs, i.e.
key S1 is connected to input E1
key S2 is connected to input E2
key Sx is connected to input Ex.

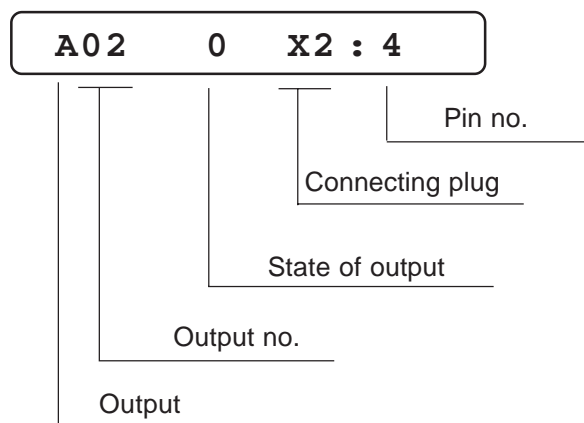Th operating state of the input is signalled in the 7th digit of the display.
Key/switch open $\rightarrow$ display: 0
Key/switch closed $\rightarrow$ display: 1

In the righthand part of the display, the connecting plug and the pin number to which the displayed input is connected are shown for the purpose of reference.

Test block 2: Outputs
Display:

```
A02    0   X2:4
```

          Pin no.

          Connecting plug

          State of output

          Output no.

          Output

The function assigned to the ouput displayed can be seen from chapter 12 „Connections Diagram for Connectors".

The designations A (for output) are located on the lefthand side of the connectors shown.
The solenoids/solenoid valves assigned to the outputs are designated Y in the connections diagram and have the same numbers as the associated outputs, i.e.
solenoid Y2 is connected to output A2
solenoid Y3 is connected to output A3
solenoid Yx is connected to output Ax

The operating state of the output displayed is signalled in the 7th digit of the display.
Output not activated → display: 0
Output activated → display: 1

To activate an output, use key D+. Deactivation is made automatically after approx. 2.5 secs have elapsed or can be caused by using key D-.

In the righthand part of the display, the connecting plug and the pin number to which the displayed output is connected are shown for the purpose of reference.

Test block 3: Speed control unit (SWG)
Display:

```
SWG    0
```

The treadle can be actuated to operate consecutively all 16 steps of the speed control unit.

The following is displayed in digits 6, 7 and 8

–2 / –1 / 0 / +1 / 1D / 2D / … / 12D, when the speed control unit is in proper condition.

Test block 4: Synchronizer (IWG)
Display:

```
IWG   000  0
```

This test block permits to check the synchronizer (position control unit). For this purpose, the shaft accommodating the synchronizer is rotated manually.

The synchronization track is signalled in digit 11 of the display. At the first change of the display in digit 11, from 0 to 1, the increments (pulses) of the synchronizer are counted and shown in display digits 7, 8 and 9.
This display runs from 0 through 239 when the synchronizer is in proper condition.

Test block 5: Potentiometer R1
Display

```
R1    xxx%
```

This test block permits to check potentiometer R1 on the control box.
The display is in a proportion (%) of total resistance.
Turning the potentiometer axle causes the display to vary from 0 through 100.
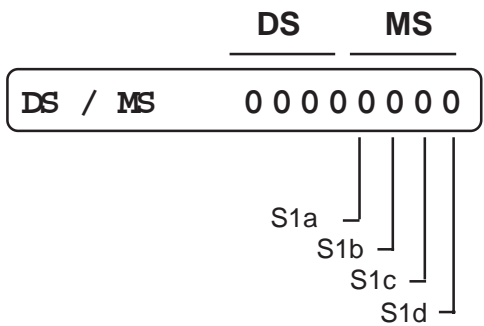
Test block 6: Selectors
Display

```
WS1    0
```

This test block permits to check the 5 selectors (WS1 ... WS5) on the control box.
The oprating state is shown in digit 7 of the display. To advance to the next selector, use key B+ or B-.
The operating state is signalled   by 0 and 1 for WS1, WS2 and WS3 and
                                        by 0, 1 and 2 for WS4 and WS5.

Test block 7: Rotary switch / miniature switch
Display:

```
              DS        MS
         _____  _____
 ┌─────────────────────────────────┐
 │ DS / MS      0 0 0 0 0 0 0 0     │
 └─────────────────────────────────┘
                  │ │ │ │
         S1a ─────┘ │ │ │
           S1b ─────┘ │ │
             S1c ─────┘ │
               S1d ─────┘
```

This test block can be used for checking rotary switch DS and miniature switch MS (S1a, S1b, S1c, S1d).

To deactivate the test routine, turn the mains power switch OFF.