

REV NO. 0/1	TITLE	CONT ON SHEET 2	SH NO. 1
224X430AA	LOWER CARD, 193X548AAC01 ENGINEERING SPEC & TEST INSTRUCTIONS		
CONT ON SHEET 2	FIRST MADE FOR		

1.0 GENERAL

The following covers the features, performance and test instructions for the subject card. The card is designed to operate in a Valutrol Maxspeed Crane Control system.

The basic card function is to control the hoist motor shunt field excitation from the MFC card as a function of armature voltage (VFB) and armature current (2CFB) when operating in the lower mode.

The card performs the following functions:

- 1.01 Provides a field weakening signal proportional to the VFB voltage.
- 1.02 Provides a field strengthening signal when the regenerative armature current exceeds certain preset bias levels.
- 1.03 Provides a switching circuit for connecting the diagnostic reference, LR, to MFC (FDR) when in "Diagnostic Run" mode.
- 1.04 Provides an amplifier for auxiliary use.

2.0 PERFORMANCE

When subjected to the operating conditions in section 2.04 the card performance will be as follows:

2.01 Input/Output

Tab 31, 15, 2	Power supply inputs +20V, COM, -20V
Tab 16	Voltage feedback from MCC (VFB)
Tab 17	Diag. ref. (if used) from DGC (FDR)
Tab 20	Current signal from HC (2IABS)
Tab 22	Cur. prog. inhibit input from HC (KL)
Tab 25	Voltage control output to HC (LV)
Tab 6	Current control output to HC (LI)
Tab 30	Response input from tabs 18,21,24 or 25
Tab 3	Response input from tabs 6,7,8 or 10
Tab 27	Diag. ref. input from DGC (LR)
Tab 28	Diag. ref. output to MFC (FDR)
Tab 29	Diag. Run switch ref. from DGC (MAC)
Tabs 9, 11, 12, 13	Auxiliary amplifier connections

REVISIONS

AW (BW)
5B (8) M
5D (CD)
5E (3) BK
5R (2) BW

PRINTS TO

MADE BY H.O. Loberg	7/18/78	APPROVALS	DCM&G SVPO	DIV OR DEPT.	224X430AA
ISSUED			Erie, PA	LOCATION	CONT ON SHEET 2 SH NO. 1

REV NO. <i>B1</i>	TITLE	CONT ON SHEET	3	SH NO.	2
224X430AA	LOWER CARD, 193X548AAG01 ENGINEERING SPEC & TEST INSTRUCTIONS				
CONT ON SHEET	3	SH NO.	2	FIRST MADE FOR	

2.02 Field Weakening by Armature Voltage (VFB)

With VFB = 5V the field will be weakened to a minimum level of 20% of rated with the MFL potentiometer on the Hoist Card turned fully CCW. The gain from tab 16 and 17 to tab 25 is 1.0.

Filtering of the output stage is provided at time constants of 2.7, 2, 1.4 and .7 second with tab 30 connected to tabs 25, 24, 21 and 18 respectively.

2.03 Field Strengthening by Armature Current (2CFB)

The current signal, 2CFB. = $-2 \times \text{CFB}$. For 100% regenerative current while lowering 2CFB = +5V.

The field increase as a function of 2CFB is controlled by three amplifier stages. Each amplifier stage will increase the field by 5.2% of rated current per volt output at tabs 19, 26 and 23. Or a sum of voltages at tab 19, 26 and 23 equalling 19.3 volts corresponds to a field current reference increase of 100% of rated.

Tab 19: The first programming stage will increase the field current proportional to the 2CFB signal with no offset bias. The gain from tab 20 to tab 19 can be adjusted by the SL1 potentiometer from -.47 to -2.15. The corresponding % field current increase per % armature current increase is .12 to .57.

Tab 26: The second stage can be biased off such that additional field increase starts anywhere from 0 to 120% of rated arm. current. The voltage of test post LB2 for a bias of 100% current is -15.8V.

The gain from tab 20 to tab 26 can be adjusted by the SL2 potentiometer from -1.0 to -4.5. The corresponding % field current increase per % armature current increase after the bias level is reached is .26 to 1.14.

Tab 23: The third stage is similar to the second with -15.8V at LB3 corresponding to a bias level of 100% armature current.

The gain from tab 20 to tab 23 is -1.77 to -7.5. The corresponding % field current increase per % armature current increase is .46 to 1.9.

The output stage has a gain of .5 from tabs 19, 26 and 23 to tab 6 such that -9.64V at tab 6 provides an additional 100% field current reference.

Filtering of the output stage is provided at time constants of 4, 3, 2 and 1 seconds with tab 3 connected to tabs 6, 8, 7 and 10 respectively.

When the CEMF signal to the Hoist Card is negative, a negative bias voltage is applied at KL, tab 22, to prevent any output from the circuit while hoisting.

REVISIONS

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5E(3)BK

5R(2)BW

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MADE BY H.O. Loberg	7/18/78	APPROVALS	DCM&G	SVPO	DIV OR DEPT.	224X430AA
ISSUED			Erie, PA		LOCATION	CONT ON SHEET 3 SH NO. 2

REV NO. 1	TITLE	CONT ON SHEET 4	SH NO. 3
224X430AA	LOWER CARD, 193X548AAG01 ENGINEERING SPEC & TEST INSTRUCTION		
CONT ON SHEET 4	FIRST MADE FOR		

2.03 (Cont'd)

Diagnostic

In the "Diagnostic Run" mode -20V is applied from DGC (MAC) to DMAC, tab 29. This closes FET switch, T2, connecting tab 27 to tab 28, which then applies the diagnostic reference, LR, to MFC (FDR).

2.04 Operating Conditions

Power Supply: $+20V \pm 1V$
 Temperature: 0 to $+75^{\circ}C$
 Humidity: 24 hrs. in 90% humidity at $40^{\circ}C$
 Voltage to Ground: 600V

2.05 The power supply requirement is mA at +20V and mA at -20V.

3.0 TEST INSTRUCTIONS

The following describes the recommended test procedure for the Lower Card.

Set all potentiometers fully CW.
 Connect tabs 25 to 30, 6 to 3, 12 to 9.
 Connect tab 28 to common, a 10K resistor from tab 27 to common
 and a 10K resistor from tab 27 to +20V.
 Apply power to the card.
 Apply inputs and verify voltage measurements as indicated.

3.01 Input: VFB(16) = FDR(17) = 0
 Output: LV(25) = $0 \pm .05V$

3.02 Input: VFB(16) = +10.0V
 Output: LV(25) = $+10.0V \pm .3V$
 Tab(24) = $7.50V \pm .4V$
 Tab(21) = $5.0V \pm .3V$
 Tab(18) = $2.5V \pm .15V$

3.03 Input: FDR(17) = +10.0V
 Output: LV(25) = $+10.0V \pm .3V$

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PRINTS TO

MADE BY H. O. Loberg	7/18/78	APPROVALS 1/8/80	DCM&G SVPO	DIV OR DEPT.	224X430AA
ISSUED	7/18/78	Erie, PA	LOCATION	CONT ON SHEET 4	SH NO. 3

REV NO. 2

TITLE

CONT ON SHEET FL SH NO. 4

224X430AA

LOWER CARD, 193X548AAG01
ENGINEERING SPEC & TEST INSTRUCTION

CONT ON SHEET FL SH NO. 4

FIRST MADE FOR

3.04 When a step input of 10V is applied to tab 16 or to tab 17 as in 3.02 and 3.03 the voltage at tab 25 should come up to 10V in an exponential fashion reaching 6V after 2.0 to 3.5 seconds.

REVISIONS

3.05 Input: 2CFB (20) = 0
Outputs: Tabs 19, 26, 23, 5: $\pm .40V$
Tab 6: $\pm .50V$

3.06 Input: 2CFB (20) = +1.0V
Outputs: Tab 19: $-2.4V \pm .25V$
Tab 26: $\pm .40V$
Tab 23: $\pm .40V$

Turn LB2 and LB3 fully CCW:

Tab 26: $-4.85V \pm .5V$
Tab 23: $-8.3V \pm .8V$
Tab 5: $+7.8V \pm .8V$
Tab 6: $-7.8V \pm .8V$
Tab 8: $-5.85V \pm .6V$
Tab 7: $-3.9V \pm .4V$
Tab 10: $-1.95V \pm .2V$

When a voltage step is applied at tab 20 the voltage at tab 6 should increase exponentially in magnitude and reach 60% of its final value in 3.5 to 4.5 seconds.

3.07 Input: Tab 11 = 10.0V
Output: Tab 9 = $-10.0V \pm .2V$

3.08 Input: DMAC (29) = 0
Output: LR (27) = $+10V \pm 1V$

3.09 Input: DMAC (29) = -20V
Output: LR (27) = $\pm .1V$

3.10 Test Conditions

Same as 2.04

2/13/79
Chg 3.04, 05, 06
10/5/79

2

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CONT ON SHEET

FL

SH NO. 4