COUNTER DRIVE GENERATOR GE2/588
ASSOCIATED MODIFICATIONS TO WATESTA E.T.I.

Introduction

The GE2/588 forms part of a telecine equipment[1,2,3], a video-tape machine or a Keller machine; it can also be used to drive a digital clock. The GE2/588 accepts pulse information from the associated machine and provides:

(a) pulses which define both the speed of rotation and the direction of rotation of the main-drive shaft in the associated equipment;
(b) machine identification signals;
(c) indicator *Reset* signals
(d) link-ready information (to indicate that the GE2/588 is powered and is connected to a decoder).

The generator codes this information and transmits it as a balanced signal, via a three-wire connection, to the decoder.

The decoder forms part of a modified Watesta Elapsed Time Indicator (E.T.I.); it resolves the transmitted signal into its constituent parts and uses the information so derived to drive the indicator display. Up to five decoders can be connected to one GE2/588.

The GE2/588 is constructed on CH1/18C chassis with index-peg positions 5 and 30. Power supplies at −24 volts are required. Note that the unit will function correctly only if the supply is within ±5% of −24 volts.

The decoder is contained within the case of the elapsed-time indicator. It obtains power at +6·8 volts, +6 volts and −3·3 volts from an integral mains-driven power supplier.

General Specification

GE2/588 for Telecine or Keller Applications

Forward Pulses (applied between pins 6 and 10)	2 V p-p ±0·25 V (negative-going)
Reverse Pulses (applied between pins 5 and 10)	2 V p-p ±0·25 V (negative-going)
Reset Pulse (applied by local button or between pins 12 and 10)	an impedance change from more than 120 kilohms to less than 1·2 kilohms
Base Line Voltage (pin 10)	0 V ±0·5 V
Forward Pulse Duration (at 50% amplitude)	not greater than 2 ms
Reverse Pulse Duration (at 50% amplitude)	not greater than 2 ms
Reset Pulse Duration	not less than 6 ms
Mark Space Ratio	not greater than 1:1
Output Impedance (quiescent state)	620 ohms
Output Impedance (during pulses)	less than 150 ohms between 0 Hz and 20 kHz
Power Requirements	150 mA max at 24 V

GE2/588 for Video-tape Applications

Forward Pulses (applied between pins 2 and 10)	6 V p-p ±1 V (positive-going)
Reverse Pulses (applied between pins 3 and 10)	6 V p-p ±1 V (positive-going)
Base Line Voltage (pin 10)	0 V ±1 V
Other parameters as above	

Decoder

Input	the coded output of the GE2/588
Input Impedance	68 kilohms
Outputs	each of the five outputs can be at 0 volts or at ±6 volts, depending on the operating conditions (see under Maintenance).

Mains Input	230—260 V, 47—53 Hz
Current Consumption	15 mA at 240 V

General Description

The output of the GE2/588 is partially voltage-coded and partially time-coded and appears on pins 13 and 14 of the unit connector. The five items of information that may be contained in the output signal (only three items are present at any one time) are defined as follows:

Machine-ident information is represented by a standing potential of either −10 volts or −14 volts, on pin 14.

Link-ready information is represented by a standing potential of −12 volts on pin 13.

Forward pulses are 10 volts p-p, positive-going, on pin 13 and 10 volts p-p, negative-going, on pin 14.

Reverse pulses have the same amplitude as forward pulses but are reversed in polarity.

Reset information takes the form of a long-duration reverse pulse; time sensors in the decoder separate reverse pulses from reset pulses.

Circuit Description

GE2/588

A simplified block diagram of the GE2/588 is given in Fig. 1 and a complete circuit diagram is given in Fig. 2. The voltages given in the following description are all measured with respect to the 0-volt line (pin 10) and *not with respect to chassis.*

(*a*) *Telecine or Keller Applications*

Forward-running information appears as a train of 2-volt p-p negative-going pulses on pin 6. These pulses are applied via R8 to inverter-amplifier TR3 and via D2 and R10 to inverter-amplifier TR8. The output of TR3 is inverted again by TR5 and the resulting signal appears as a 10-volt p-p train of negative-going pulses at pin 14. The output of TR8 appears as a 10-volt p-p positive-going pulse train at pin 13.

Reverse-running information appears as a train of 2-volt p-p negative-going pulses on pin 5. These pulses are applied via two inverting stages to pin 13 and via a single inverting stage to pin 14. Thus positive-going pulses appear at pin 14 and negative-going pulses appear at pin 13. The pulse amplitudes are 10-volts p-p, as for forward-running.

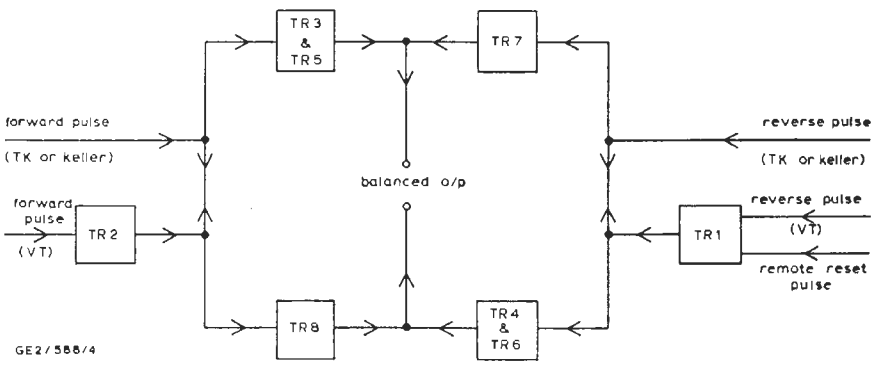

Fig. 1 Simplified Block Diagram of the Counter-drive Generator GE2/588

Initially, a reset pulse has the same effect on the indicator as a reverse pulse; thus on receipt of a reset pulse the display moves back one digit and then, when the duration of the pulse identifies it as a reset command, resets to zero.

At the decoder the various voltage transitions are detected by linear integrated circuits which are wired as voltage comparators. The time-sensing is done by integrators.

Diode D3 prevents transistors TR3 and TR7 from bottoming simultaneously if, under fault conditions, both transistors are fed with pulses at the same time. The purpose of the diode is to prevent excessive current being drawn from the power supply. Diode D4 performs the same function for transistors TR4 and TR8.

A reset pulse takes the same form as a long-duration reverse-running pulse. Reset pulses can

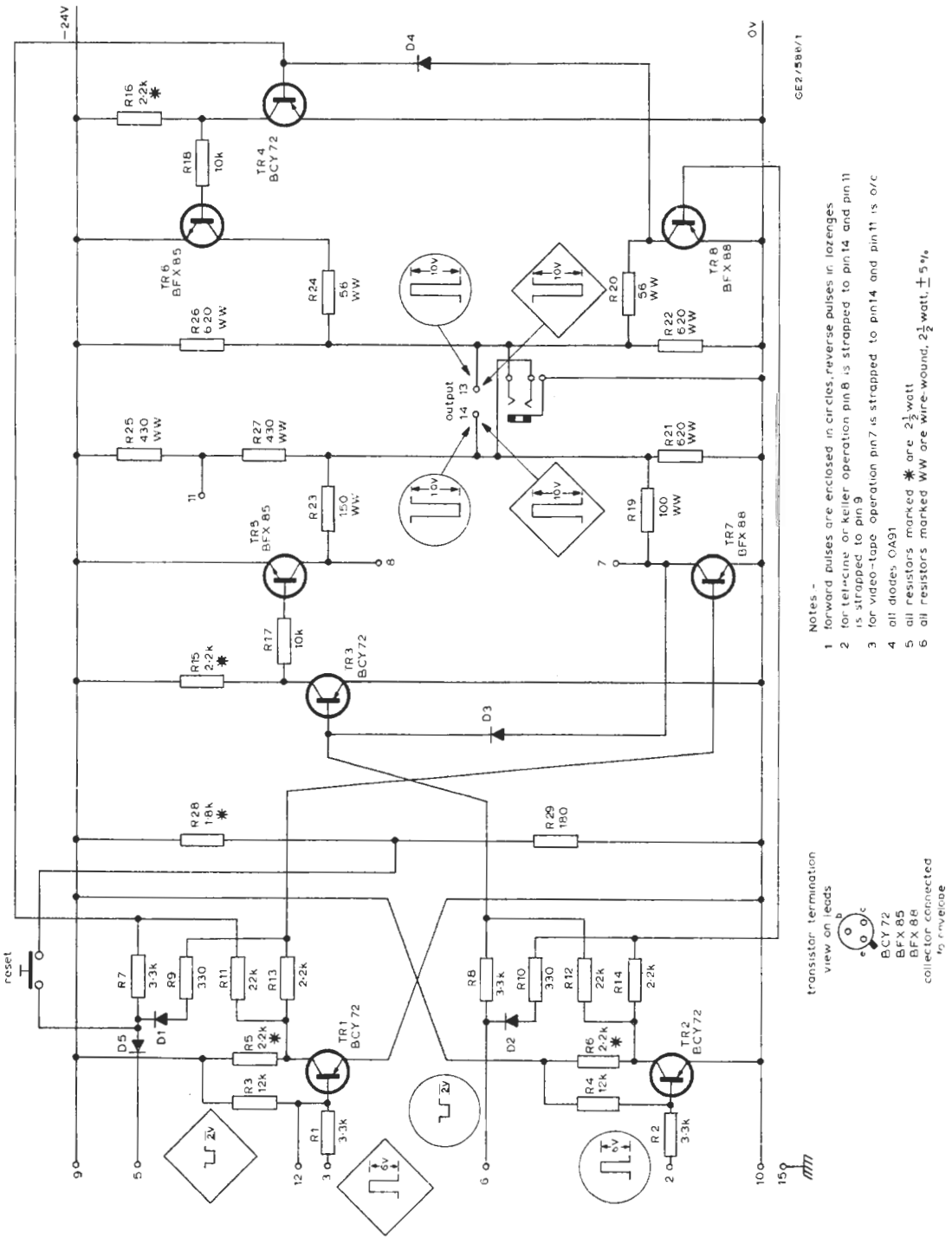

Fig. 2 Circuit of the Counter-drive Generator GE2/588

be applied to the unit either locally or remotely. A local reset pulse is obtained by pressing the *Reset* button on the front panel of the unit; this action applies a suitable negative-going pulse (derived from the junction of R28 and R29) to transistors TR4 and TR7. Diode D5 prevents the pulse being fed back to the previous unit via pin 5 of the connector. A reset pulse can be initiated from a remote position by temporarily connecting a resistance of less than 1·2 kilohms between pins 10 and 12 of the unit connector. This connection changes the base-bias conditions of TR1 and cuts off the transistor whereupon a negative-going pulse appears at the collector of TR1 and is applied to transistors TR4 and TR7 as a reset pulse.

In addition to carrying Forward, Reverse and Reset pulse information the output pins of the unit carry also steady d.c. potentials which define the link-ready and machine-ident conditions. The link-ready information consists of a standing potential of −12 volts on pin 13 and the machine-ident information (for telecine and Keller machines) is provided when a standing potential of −14 volts is present on pin 14; i.e. when pin 8 is linked to pin 14 and pin 9 is linked to pin 11.

(*b*) *Video-tape Applications*

Forward-running information appears as a train of 6-volt p-p positive-going pulses on pin 2. These pulses drive TR2 into cut-off and the resulting negative-going pulses which appear at the collector of TR2 are applied to transistors TR3 and TR8, as described previously for telecine applications.

Reverse-running information appears as a train of 6-volt p-p positive-going pulses on pin 3. These pulses drive TR1 into cut-off and the resulting negative-going pulses which appear at TR1 collector are applied to transistors TR4 and TR7, as described previously for telecine applications.

The video-tape machine-ident signal consists of a steady potential of −10 volts on pin 14. This potential is obtained by linking pins 7 and 14 and leaving pin 11 disconnected. The link-ready potential (−12 volts on pin 13) is the same as for telecine applications.

(*c*) *Digital Clock Applications*

Negative-going field-drive pulses are applied to pin 6 and the unit functions as if it were handling forward-running telecine information. Pin 8 is linked to pin 14, and pin 9 is linked to pin 11.

Decoder

The circuit of the decoder, which is contained in the modified Vatesta Elapsed Time Indicator, is given in Fig. 3.

The coded output of the GE2/588 is applied to the decoder between pins 13 and 14. The six resistors R1 to R6 attenuate the incoming signal to a level which is suitable for application to the linear integrated circuits IC1 to IC3. Diodes D1 and D2 prevent any positive voltage excursions from damaging the circuit; however, such excursions will appear only if the routing between the decoder and its source is faulty.

Voltage comparator IC1 detects forward-running and link-ready signals, because both these items involve transitions between −12 volts and 0 volts at the decoder input. The forward-running pulses which appear at the output of IC1 are ready for direct application to the indicator, but the link-ready information is fed to the indicator via an integrator comprising R8, C1 and TR1. The reference potential for the stage is derived from the −3·3 volt line.

Voltage comparator IC2 detects voltage transitions between −12 volts and −24 volts; i.e. reverse-running pulses and reset commands. From the output of the comparator the reverse-running pulses are fed to the indicator via the inverter stage TR2. The longer-duration reset pulses are applied via D5 and R15 to C2. The discharge path for capacitor C2 is via a Schmitt trigger stage which comprises transistors TR3 and TR4. The pulse output from TR4 has a very fast fall-time and this triggers the reset circuit of the indicator. The reference potential for the stage is derived from the −3·3 volt line.

Voltage comparator IC3 detects the machine-ident signal. The signal applied to the comparator is an attenuated version of the original machine-ident signal; (either −10 volts or −14 volts) the presence of other information is nullified by the effect of resistors R7 and R12 and capacitor C3. In IC3 the machine-ident signal is compared with a reference voltage and the resulting output signal is amplified and inverted by transistor TR5. The potential at the collector of TR5 is +6 volts when the ident signal is derived from a video-tape machine and 0 volts when it is derived from a telecine or Keller machine. The output from TR5 drives two loads; these are the appropriate (VT or TK) indicator lamp and the counter-gating circuit in the indicator. The feed to the counter-gating circuit is necessary because telecine machines give 50 counter pulses per second when running at normal speed, but video-tape machines give only

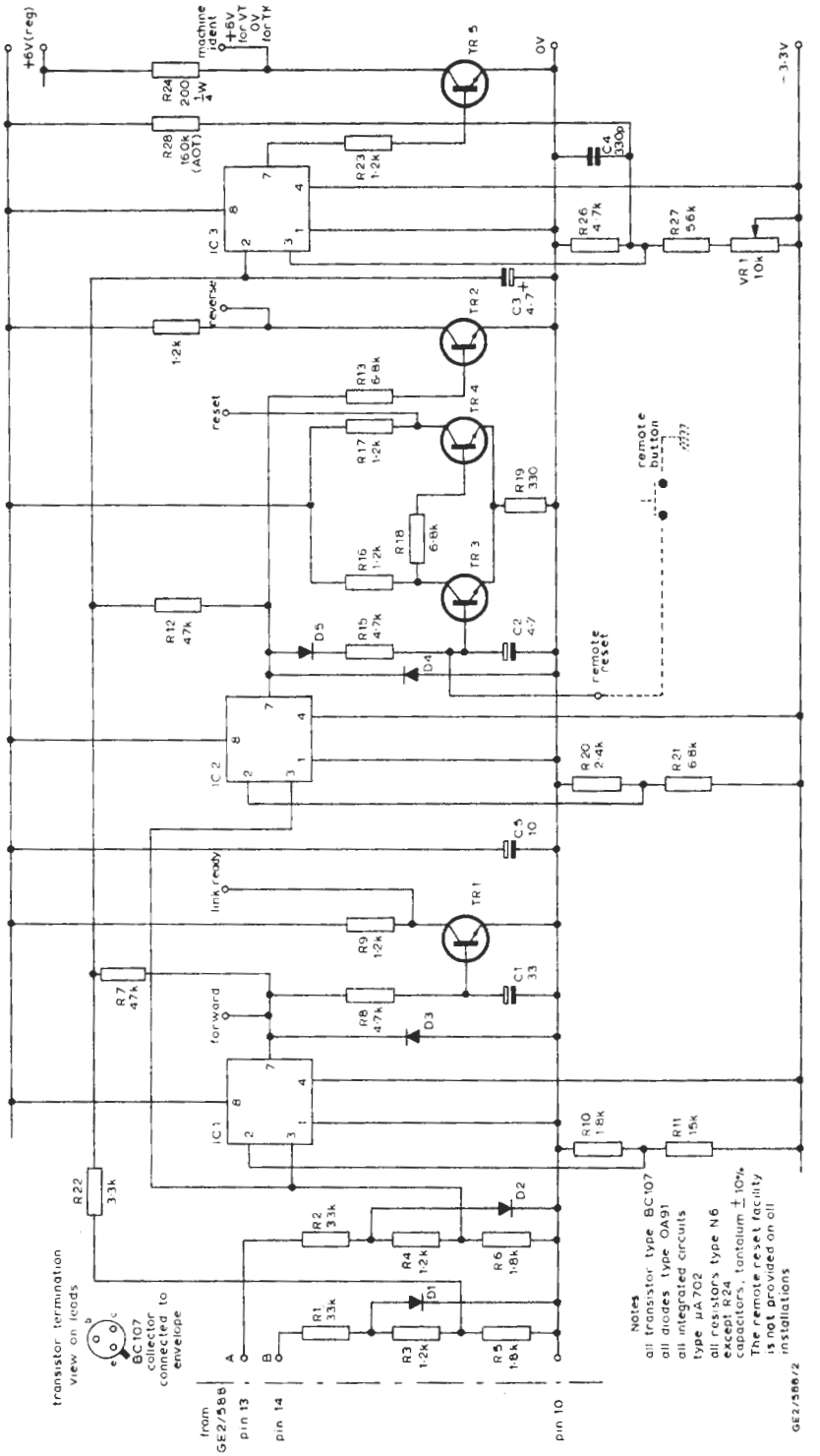

Fig. 3 Circuit of the Decoder

two pulses per second. Therefore a feed of machine-identity information must be applied to the counter-gate circuit in the indicator so that the correct divisor can be applied to the counting pulses.

Power Supply and Machine Ident Display

The modifications to the elapsed-time indicator are given in Fig. 4.

The secondary winding of mains transformer T1 feeds a bridge-rectifier circuit. The negative output from the bridge is reduced to −3·3 volts by zener diode D8. The positive output from the bridge is reduced to 6·8 volts by zener diode D7 and is applied also to a series stabiliser formed by TR6 which provides a regulated output of +6 volts.

The +6·8-volt and −3·3-volt supplies are used in the decoder. The 6-volt regulated supply is used mainly for the heavier loads of the machine-ident display.

Link-ready and machine-ident signals from the decoder are applied to the inputs of a double *Nand* gate (a *Nand* gate is an *And* gate followed by an inverter) which is formed from a SGS—Fairchild DTμL module type 9932. The logic of the module is such that the output of each gate is 0 volts when both inputs to that gate are positive-going (6 volts). Therefore, when both the link-ready and machine-ident inputs are at +6 volts the output of the first gate (pin 6) will be 0 volts and the VT lamp will light. However, when the link-ready input is at +6 volts and the machine-ident input is at 0 volts, the output of the second gate will be at 0 volts and the TK lamp will light.

TABLE 1

(*a*) *With pin 9 linked to pin 11 and pin 8 linked to pin 14 (TK)*

Inputs		*Input Duration (ms)*	*Outputs*		*Function*
pin 6	pin 5		pin 13	pin 14	
0	0	–	−12	−14	Ready
−2	0	less than 2	−2	−24	Forward
0	−2	less than 2	−22	−4	Reverse
Reset		greater than 6	−22	−4	Reset

(*b*) *With pin 7 linked to pin 14 (VT)*

Inputs		*Input Duration (ms)*	*Outputs*		*Function*
pin 2	pin 3		pin 13	pin 14	
0	0	–	−12	−10	Ready
+6	0	less than 2	−2	−20	Forward
0	+6	less than 2	−22	0	Reverse
Reset		greater than 6	−22	0	Reset

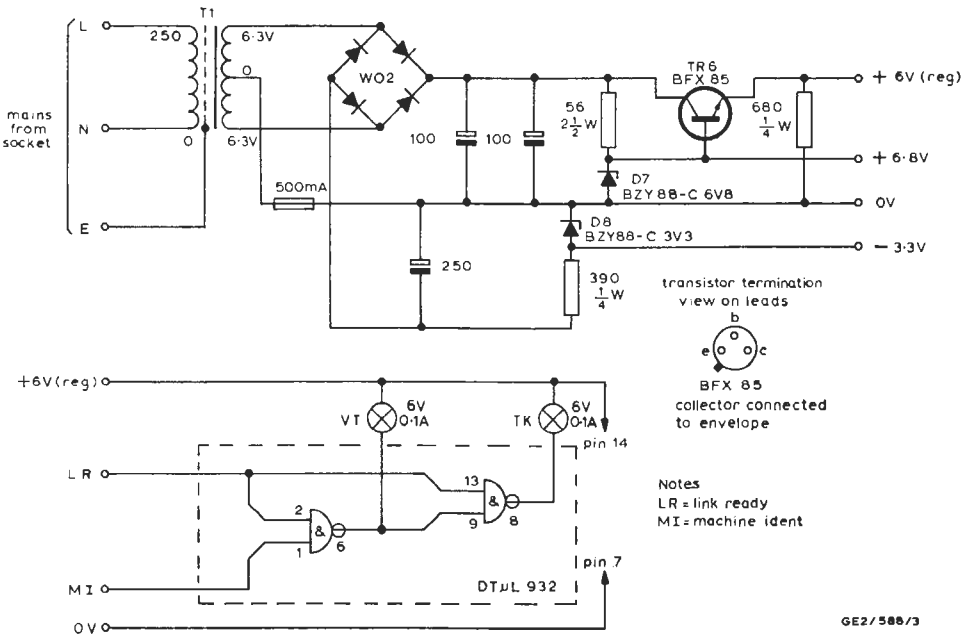

Fig. 4 Power-supply and Machine-ident Display Circuit

Maintenance

Coder

When the GE2/588 is in a quiescent state, i.e. when the associated machine is stationary, transistors TR1 and TR2 should be conducting and TR3, TR4, TR5, TR6, TR7, TR8 should be cut off. The voltages present on the unit connector for the various modes of operation are given in Table 1.

Decoder

To set up the reference potential for integrated circuit IC3 on the decoder proceed as follows:
Apply −12 volts to decoder inputs A and B.
Adjust VR1 so that the potential at the machine-ident output just changes to +6V.

If VR1 has insufficient range to obtain the desired result, change the value of the adjust-on-test resistor R28 and try again.

Note: Variable resistor VR1 has a range equivalent to the gap between the resistance values used for the adjust-on-test resistor. The value of R28 is usually between 130 kilohms and 180 kilohms.

References to Typical Associated Equipment

1. Counter Drive Pulse Generator GE2/542.
2. Colour Telecine Equipment EP6/505.
3. Vidicon Telecine EP6/501.

See overleaf for Table 2

Table 2 gives the potentials at the decoder input and output terminals for the various input conditions.

TABLE 2

Inputs		*Input Duration (ms)*	*Function*	*Outputs*					*Lamps*
pin A	pin B			L.R.	F	R	Res	M.I.	
0	0	greater than 500	No Link	0	+6	0	+6	+6	
−10	−12	—	Ready	+6	0	0	+6	+6	VT
−20	−2	less than 2	Forward	+6	+6	0	+6	+6	VT
0	−22	less than 2	Reverse	+6	0	+6	+6	+6	VT
0	−22	greater than 6	Reset	+6	0	+6	+6	+6	VT
−14	−12	—	Ready	+6	0	0	+6	0	TK
−24	−2	less than 2	Forward	+6	+6	0	+6	0	TK
−4	−22	less than 2	Reverse	+6	0	+6	+6	0	TK
−4	−22	greater than 6	Reset	+6	0	+6	+6	0	TK

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