VD DIGITAL READOUTS FOR MILLING MACHINES

INSTALLATION PARAMETERS

OPERATION	LAMP ON	OPERATION SEQUENCE	PROCEDURE
ENTERING OF MACHINE PARAMETERS		PRES AND +- SIMULTANEOUSLY ON-OFF SWITCH	• With the DRO off, depress the PRES and +- keys simultaneously and switch on while holding both keys pressed down. • The centre of each axis on the screen will display a "5" or a "0". This position identifies the type of scale installed on each axis. • A "0" may appear to the right of each axis on the screen. This position shows the "on" situation of the third decimal.
IDENTIFYING THE SCALES OF EACH AXIS		X , Y OR Z / ·	• Starting from the knowledge of the types of scales in the system, press AXIS / · . Each time AXIS / · is pressed, the axis is identified as 5 or 0 . • The models S, M, SE and E must be identified as 0 . • The models SD, TLD, SM, TLM, C and M must be indentified as 5 .
DISPLAYING THE THIRD DECIMAL		0	• Press the 0 key. Each time 0 is pressed, the third decimal will or will not be displayed.
CHANGE OF COUNTING SIGN		X , Y OR Z / −	• Press AXIS / − Each time AXIS / − is pressed, the counting sign on the particular axis changes.
RESTORING NORMAL OPERATION		ON-OFF SWITCH/ ON-OFF SWITCH	• NOTE • In the state of entering machine parameters, neither counting nor preselection take place. To put the DRO into its normal state, disconnect it and switch it on by means of the on-off switch situated on the rear panel.

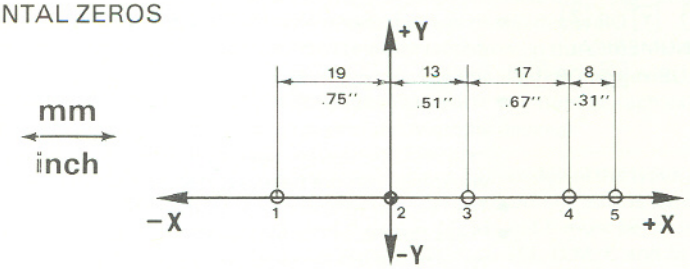
INSTRUCTIONS FOR USE

SWITCHING ON	ANY	ON-OFF SWITCH / CLEAR	• Operate the on-off switch situated on the rear panel of the DRO. The screen will flash the digit "1" on all axes. • Press " CLEAR ". The flashing will disappear and the screen will display the values which were there previously, and the mode of operation. • If the digits which flash are "2" or "4", this means that the DRO has had a memory fault and has therefore lost the information on the machine parameters (type of scales, system resolution and direction of counting). In this cause, input these parameters again.
INCREMENTAL ZERO RESET	ONLY INCH CAN BE ON	CLEAR / X , Y OR Z	• The incremental zero means the various origins which can be entered in performing an operation, independently of the absolute origin of the workpiece. • The +- and ABS lamps should be off. • Press the CLEAR key. • Press the key of the axis which is to be reset. • Repeat for each axis.
ABSOLUTE ZERO RESET	ABS AND POSSIBLY INCH.	CLEAR / X , Y OR Z	• The coordinate origin of a workpiece is called the "absolute zero". • The ABS lamp should be on and the +- lamp off. • Press the CLEAR key. • Press the key of the axis which is to be reset. This operation automatically resets the incremental counting.
MACHINE ZERO SEARCH	+- AND POSSIBLY INCH.	X , Y OR Z / MOVEMENT THROUGH THE REFERENCE ZONE	• The machine zero is a fixed reference which is situated on the scale and is identified by two labels placed on the scale and/or the machine. • The +- lamp should be on. • Move the machine along the chosen axis until the arrow on one of the labels coincides with the thick line on the other. • Press the key of the chosen axis. A number of zeros will appear on the left of the screen. • Shift the axis so that the arrow on one label runs along the thick line on the other. When the zeros and digits on the left of the screen disappear, it means that the machine zero has been located, and the measurement which appears on the screen is the distance between the machine zero reference and the point at which the machine is. • Repeat for each axis. This operation automatically resets the ABSOLUTE and INCREMENTAL countings.
PRESET	ONLY INCH CAN BE ON	X , Y OR Z / (−) / NUMERICAL VALUE / PRES	• This is used when, for convenience, on particular jobs, it is preferred to operate from coordinate towards zero instead of following the usual procedure of working from zero towards coordinate. • The +- and ABS lamps should be off. • Press the key of the axis on which the preselection is to be carried out. All the zeros to the left of the decimal point will be displayed but not the point itself. • Press the numeral keys for the value to be preset with the opposite sign. • Press the PRES key. • Repeat for each axis. • NB: If after preselection has started, the machine moves before the operation is completed, it will be observed that this movement is not displayed on the screen. In such cases, press CLEAR and the screen will display the total resulting from adding the movement which has taken place to the coordinate value that was there before preselection.

OPERATION	LAMP ON	OPERATION SEQUENCE	PROCEDURE
TOOL OFFSETS: USING THE ⊕, ⊖ KEYS IN MILLING OPERATIONS	ONLY INCH CAN BE ON	X, Y OR Z / NUMERICAL VALUE / ⊕ OR ⊖	• In milling operations, the tool radius can be added to or subtracted from the value displayed so as to be able to operate with actual drawing coordinates and merely using the ⊕ or ⊖ sings. • The rule for applying a ⊕ or ⊖ sign is as follows: if the position of the actual coordinate of the workpiece is more positive with respect to the coordinate centre than that of the centre of the tool, the sign applicable is ⊕ . If the position of the actual coordinate of the workpiece is more negative than that of the centre of the tool, the sign applicable is ⊖ . • The +- and ABS lamps should be off. • Press the key of the axis on which the addition or subtraction is to be effected. All the zeros to the left of the decimal point will be displayed, but not the point itself. • Key in the value (diameter) to be added or subtracted. • Press the ⊕ or ⊖ key according to the rule in the second paragraph. Half of the value entered will be added to / subtracted from the value displayed. • The value of the correction is recorded in the memory, allowing further corrections to be made to the values displayed by merely pressing AXIS / ⊕ or ⊖ . If CLEAR / AXIS is pressed at any time during the addition/subtraction operation, the ⊕ or ⊖ value has to be entered afresh. • NB: Once the piece of work involving the correction has been completed, the correction should be cancelled by the keying sequence AXIS / 0 / ⊕ or ⊖ .
CANCELLATION OF ⊕ , ⊖ CORRECTION	ONLY INCH CAN BE ON	X, Y OR Z / 0 / ⊕ OR ⊖	• The correction is cancelled by the sequence AXIS / 0 / ⊕ or ⊖.
MEASUREMENT (INCREMENTAL, ABSOLUTE AND FROM MACHINE ZERO)	INCH CAN BE ON	OPERATE THE +- , ABS KEYS	• When the +- and ABS lamps are off, the coordinates displayed refer to the latest incremental zero entered. • When the ABS lamp is on, the coordinates displayed refer to the latest zero chosen as absolute origin. • When the +- lamp is on, the coordinates displayed refer to the machine zero. • During a series of incremental movements (starting from incremental zeros), when pressing the ABS key (lamp on) the distance to the point chosen as absolute origin is displayed. • Pressing the ABS key again (lamp off) brings back the incremental reading. • Pressing the +- key (lamp on) displays the distance to the machine zero.
WORKING IN MM / INCHES	ANY	OPERATE THE INCH KEY	• Press the INCH key. Lamp off means working in mm. Lamp on means working in inches. • The conversion applies both to the counting and to the preset values.
CANCELLATION OF OPERATION	ANY	CLEAR	• If before completing one of the above operations (except switching on) it is desired to cancel what has been done, simply press the CLEAR key. The DRO returns to the state it was in before the operation commenced.
ERROR CODES (SCREEN FLASHING)		CLEAR	Code 1 Disconnection, accidental mains failure or supply voltage drop to below rated voltage limit (-15 %). Code 2 Battery discharge below minimum accepted value to preserve memory data. See INSTALLATION PARAMETERS. Code 3 Error using the keyboard. Code 4 Incorrect data in memory when switching on the equipment. See INSTALLATION PARAMETERS. Codes 5, 6 and 7 Internal faults in circuitry. Contact local Service.

EXAMPLE OF OPERATION IN THE DIFFERENT MEASUREMENT MODES

Point 1: MACHINE ZERO
Point 2: ABSOLUTE ZERO
Point 3, 4 and 5: INCREMENTAL ZEROS

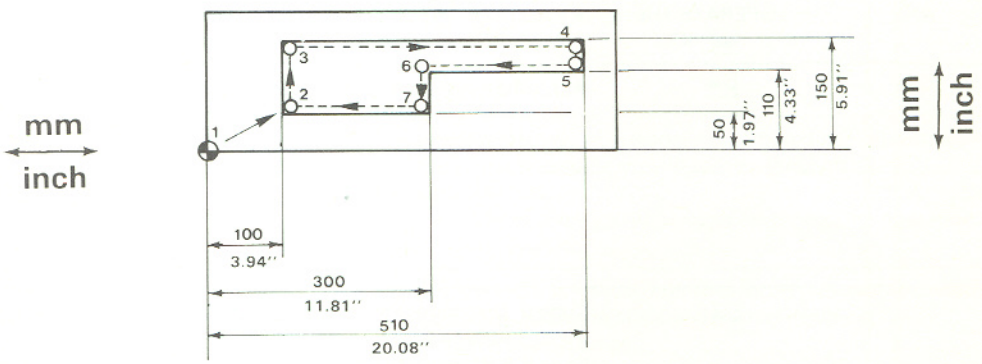


— Drilling holes in the longitudinal direction, starting from point 1.
— Carry out the resetting of the axis at point 2 (ABS lamp on, CLEAR / X).Then put the DRO on incremental (ABS lamp off).
— Proceed to point 3 and reset the axis (CLEAR / X).
— Proceed to point 4 in the same way as prior to point 3, and do the same operation there (CLEAR / X).
— Proceed to point 5.
— At point 5, the following will be seen:

- The ← and ABS lamp off, on the X : 8.00 (.31"). Distance between point 4 and 5.
- The ← lamp off and the ABS lamp on, X : 38.00 (1.5"). Distance between point 2 and 5.
- The ← lamp on and the ABS lamp off: 57.00 (2.24"). Distance between point 1 and 5.

As can be seen from this example, the DRO has three different references.

EXAMPLE OF APPLICATION OF THE ADD/SUBTRACT OPERATION (⊕ , ⊖)



Performing an internal milling operation with a 20 mm (.79"). ∅ tool starting from point 1 regarded as the workpiece zero.

— Bring the tool to point 1. With the ABS lamp on, press CLEAR / X , CLEAR / Y Both axes will zero.
— In incremental position (ABS lamp off), press X / 20 / ⊖ and Y / 20 / ⊖ (X / 79 / − and Y /. 79 / −)."
— Bring the axes to point 2. This position is X : 100 , Y : 50, (X : 3.94", Y : /1.97").
— Press Y / ⊕ and bring this axis to position 3. Y : 150 (5.91").
— Press X / ⊕ and bring this axis to position 4. X : 510 (2.01").
— Press Y / ⊖ and bring this axis to position 5. Y : 110 (4.33").
— There is no need to change the correction sign in the movement to point 6, so bring the axis to X : 300. (11.81").
— There is no need to change the correction sign in the movement to point 7, so bring the axis to Y : 50. (1.97").
— Press X / ⊖ and bring this axis to position 2. X : 100. (3.94").
— Press X / 0 / ⊕ or ⊖ , Y / 0 / ⊕ or ⊖ and traverse machine carriage to origi.

The internal milling is thus completed, with application of the tool radius corrections. In the case of external milling, the method of applying the correction is the same, i.e. workpiece more positive than centre of tool requires ⊕ correction, workpiece more negative requires ⊖ corrrection.

FAULT TRACING

— When faults occur, it is desirable to know whether the problem lies in the counter or in any of the scales and it is therefore appropriate to carry out a "swap of axes" if the following symptoms occur:

- FAILS TO COUNT OR COUNTS INCORRECTLY
- FAILS TO PERFORM SEARCH FOR "MACHINE ZERO".

— The method to be followed consists in interchanging the connectors on the rear panel of the DRO. The following possibilities may occur:

a) The fault changes axis on the screen. In this case the error will be in the scale - reader head - cable combination. Check that the connections of the connectors are OK.

b) The fault continues at the same location on the screen. In this case the error will be in the counter itself. Check that both the mains and the ground connections are correct and that the DRO's fuse is OK.

If after such checking the fault persists, call the nearest AURKI service, indicating both the model of scale (identifiable from the label placed on one end of the scale) and that of the DRO (shown on the back of it).

CAUTION

— The DRO must NOT be connected between a phase and the neutral. Where necessary, use a transformer.

— The ground must be correctly connected, since on it depends the safety both of the operator and of the equipment installed.

— The measurement given by a digital multimeter between the central point of each connector and ground must be less than 1 ohm.

WARRANTY

— The equipment is under warranty for 15 months from factory delivery date.

— This warranty covers both material and labour repair costs at AURKI.

In case of repair at customer's workshop, any travel expenses are payable by customer.

— This warranty does not cover damages and faults arised from causes not relating to normal operation of the equipment, such as blows, poor assembling or handling by untrained personnel, etc.

COMPENSATING FOR MACHINE ERRORS

Wear and deformation of the guided parts of the machines may result in measurement errors. Such errors can be compensated for by entering a factor by means of the selector switches situated on the right of the DRO plate, in two or three blocks of eight switches each. Each block corresponds to one axis (X, Y or Z).

Access for applying such compensation is by removing the three screws which secure the DRO plate to the rear panel.

MACHINE ERROR COMPENSATION IN μm/metre

Resolution scales 0,01 mm	Resolution scales 0,005 mm	Resolution scales 0,002 mm	Resolution scales 0,001 mm	POSITION OF THE SWITCHES					
				3	4	5	6	7	8
0	0	0	0	O	O	O	O	O	O
10	5	2	1	O	O	O	O	O	●
20	10	4	2	O	O	O	O	●	O
30	15	6	3	O	O	O	O	●	●
40	20	8	4	O	O	O	●	O	O
50	25	10	5	O	O	O	●	O	●
60	30	12	6	O	O	O	●	●	O
70	35	14	7	O	O	O	●	●	●
80	40	16	8	O	O	●	O	O	O
90	45	18	9	O	O	●	O	O	●
100	50	20	10	O	O	●	O	●	O
110	55	22	11	O	O	●	O	●	●
120	60	24	12	O	O	●	●	O	O
130	65	26	13	O	O	●	●	O	●
140	70	28	14	O	O	●	●	●	O
150	75	30	15	O	O	●	●	●	●
160	80	32	16	O	●	O	O	O	O
170	85	34	17	O	●	O	O	O	●
180	90	36	18	O	●	O	O	●	O
190	95	38	19	O	●	O	O	●	●
200	100	40	20	O	●	O	●	O	O
210	105	42	21	O	●	O	●	O	●
220	110	44	22	O	●	O	●	●	O
230	115	46	23	O	●	O	●	●	●
240	120	48	24	O	●	●	O	O	O
250	125	50	25	O	●	●	O	O	●
260	130	52	26	O	●	●	O	●	O
270	135	54	27	O	●	●	O	●	●
280	140	56	28	O	●	●	●	O	O
290	145	58	29	O	●	●	●	O	●
300	150	60	30	O	●	●	●	●	O
310	155	62	31	O	●	●	●	●	●
320	160	64	32	●	O	O	O	O	O
330	165	66	33	●	O	O	O	O	●
340	170	68	34	●	O	O	O	●	O
350	175	70	35	●	O	O	O	●	●
360	180	72	36	●	O	O	●	O	O
370	185	74	37	●	O	O	●	O	●
380	190	76	38	●	O	O	●	●	O
390	195	78	39	●	O	O	●	●	●
400	200	80	40	●	O	●	O	O	O
410	205	82	41	●	O	●	O	O	●
420	210	84	42	●	O	●	O	●	O
430	215	86	43	●	O	●	O	●	●
440	220	88	44	●	O	●	●	O	O
450	225	90	45	●	O	●	●	O	●
460	230	92	46	●	O	●	●	●	O
470	235	94	47	●	O	●	●	●	●
480	240	96	48	●	●	O	O	O	O
490	245	98	49	●	●	O	O	O	●
500	250	100	50	●	●	O	O	●	O
510	255	102	51	●	●	O	O	●	●
520	260	104	52	●	●	O	●	O	O
530	265	106	53	●	●	O	●	O	●
540	270	108	54	●	●	O	●	●	O
550	275	110	55	●	●	O	●	●	●
560	280	112	56	●	●	●	O	O	O
570	285	114	57	●	●	●	O	O	●
580	290	116	58	●	●	●	O	●	O
590	295	118	59	●	●	●	O	●	●
600	300	120	60	●	●	●	●	O	O
610	305	122	61	●	●	●	●	O	●
620	310	124	62	●	●	●	●	●	O
630	315	126	63	●	●	●	●	●	●

POSITION O: OPEN, OFF
POSITION ●: CLOSED, ON

— The position of selector swithc No. 1 shows whether the correction is of positive or negative sign:

POSITION O: + Sign
POSITION ●: - Sign

— The posisiton of selector switch No. 2 shows whether a multiplication factor is or is not applied to the correction value given in the table:

POSITION O: The correction value is that given in table.

POSITION ●: Multiplier the correction value given in the table by four.