



INNOVATION & IMPLEMENTATION FIRM

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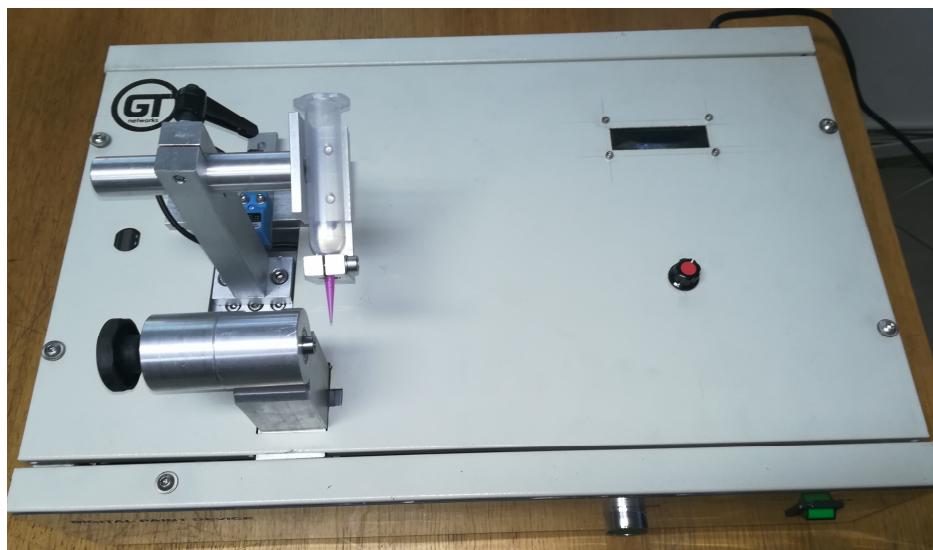
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DIGITAL PAINTING DEVICE



Operation of the device

Digital marking device (painting device) is intended for the application of colourful markings on dental drills during the production process.

Technical description

Basic device data:

Maximum actuator stroke:	15 mm
Actuator velocity:	50 mm/s
Maximum actuator force:	10N
Spindle velocity:	1000 r.p.m.
Dimensions (width x depth x height):	540 x 350 x 220 cm

Electrical installation

Closed circuit voltage:	230 VAC
Power supply:	single-phase
Power cord length	approx. 1.5m
System power:	300W
External working temperature:	5÷40°C
Humidity:	up to 50%

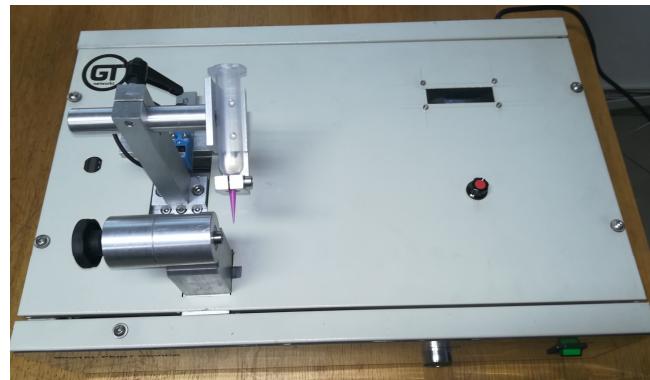
CAUTION!

High voltages occur in the device. During the work the extreme caution should be exercised and the producer should be notified about every case of improper functioning.

Structure and control

The whole marking process is managed by the industrial controller (CPU06) installed in the switchgear which simultaneously is the basis for the mechanical part (right hand picture).

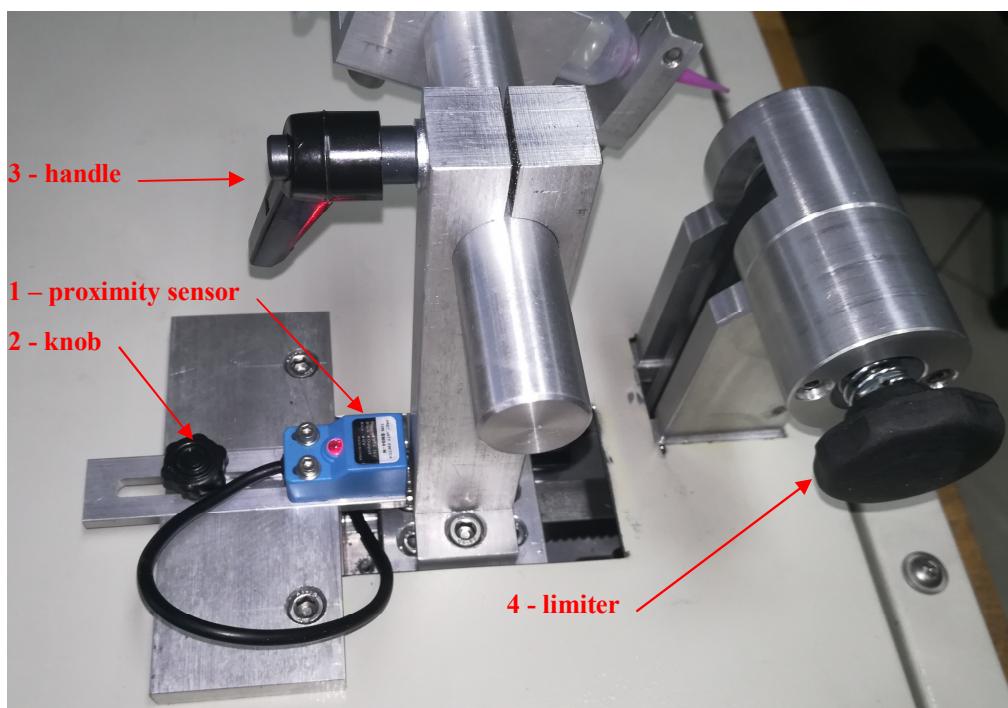
On the left, there are installed the following drives of: feed and spindle revolutions, on the right, there are electronic systems.



Actuator (linear drive) allows accurate (0.1mm) moves of the handle with the syringe within the range up to 15mm. Initial position of the actuator is set via a proximity sensor (1) installed on a mobile base (a knob on the slide (2) of the proximity sensor). Final position is set as the "L" parameter on the LCD display. L distance is calculated from the initial position, that is, from the proximity sensor. The handle of the syringe allows to regulate the extension in the lateral axis and the angle of the syringe by means of the pressing handle (3). It is also possible to adjust the extension of the syringe handle.

When turned off, as well as after the performance of the marking cycle, the voltage of the actuator motor is turned off which allows to, if necessary, move the syringe handle manually. All adjustments in the device can be made by using attached 6mm hex key

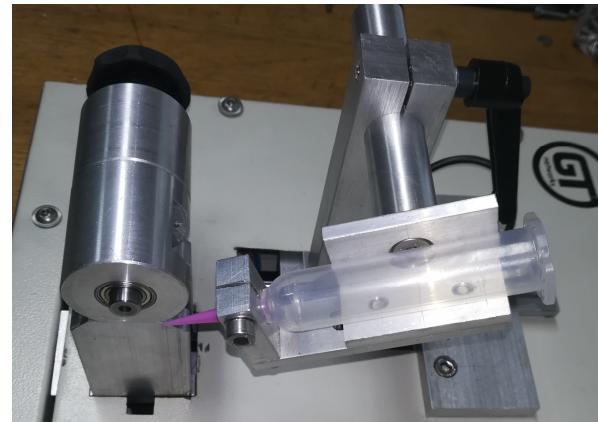
The actuator has been installed on the stepper motor of the holding torque of 2Nm. This allows the handle to move with the velocities of approx. 50mm/s and the force of 10N.



Drill handle assembly is composed of the spindle connected with the drive system through the belt connection (toothed belt) with the 12/21 ratio. Spindle drive has been

manufactured on the direct current motor of the power of 100W. On the front part of the hardened spindle there is the hole ($\varnothing 4$) for mounting replaceable drill handles. Handles for drills having the diameters of 1.6mm and 2.35 are attached to the device. The spindle has an internal hole, to which the drill is to be inserted. The limiter (4) has been made on the left hand part of the assembly. The large knob allows to adjust the depth of the drill insertion during the marking process. The range of adjustment is 10 to 40mm from the end of the drill.

On the front wall of the device, there is the power switch (POWER) and the manual trigger of the marking process (TRIGGER). On the upper wall, the liquid crystal display has and the rotational knob with the switch for setting the marking process parameters have been installed. On the rear wall, the socket for the power cord (230VAC), foot trigger connection, and the paint feeder (DISPENSER) connection have been located.



The power supply, after turning on, enters the positioning mode, that is, the actuator will be moving back for approximately one second, until the moment of the actuation of the proximity sensor. Simultaneously, on the display after the displaying of the welcoming information, the following marking process parameters previously stored in the controller's memory are presented:

- T – marking time [s];
- L – actuator extension [mm];
- V – spindle rotational velocity [%].

During switching off, the cycle counter located in the right hand corner of the display is reset. When the abovementioned actions are automatically carried out, the device is ready for operation.

Changing parameters settings

In order to change settings, the rotational switch has been installed. The following convention has been adopted: the rightwards rotations are increasing the indicated value, the leftwards rotations are decreasing it. Moving to the settings of the next parameter takes place by pressing the switch. The parameter is indicated by the “>” symbol. The parameters available to be defined by a user are: marking time (T), actuator extension (L), and the spindle rotational velocity (V).

Marking time defines how long the syringe feeder with paint will be touching the element being painted. The actuator extension defines the way from the initial position until the moment of stopping above an element being painted. The spindle velocity defines the control of the direct current motor, which is corresponding with the speed of the rotating of an element being painted.

After turning on the power supply, electronic system indicates the T parameter - marking time. After pressing the switch, the system goes to the L parameter - actuator extension. Simultaneously, the electronic equipment moves the actuator to the set location allowing an accurate setting of this distance. After the next pressing the switch, the system goes to the V parameter - rotational velocity; the actuator goes back to the off-position,

spindle drive, however, switches on the set rotational velocity. Another pressing the switch causes switching to the T parameters settings and switching off the spindle drive.

Marking cycle

The operator manually places the drill in the handle mounted in the spindle. Then, by using the manual or foot trigger the marking sequence is triggered. In the first part of the cycle, the approach of the actuator to the set position, that is, to the element being marked takes place. The path length is defined by the L parameter. Simultaneously with the triggering, the spindle drive which, during the actuator movement increases rotations to the value defined by the V parameter, is actuated. At the moment of the approach of the actuator, marking time starts being counted and the impulse is sent to the dispenser. After waiting for the moment defined by the T parameter, the regressing of the actuator to its off-position, switching off the spindle drive motor power supply, and the initiation of the dynamic braking take place. After the return of the actuator, the cycle counter on the LCD display is being increased and the marking process is accomplished. The operator may take the marked drill out of the handle manually.