ON THE STANDARDIZATION OF HOUSINGS
OF MULTICHANNEL ELECTRONIC EQUIPMENT

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Electronic instruments are widely used in medicine and biology for providing objective information about the state of biological objects. Single channel instruments measure or record only one parameter; the simultaneous measuring or recording of several parameters requires the use of multichannel equipment. Apart of the power supply units, which are common for several channels, the electronic circuits of individual channels are usually independent of one another.

The manufacture and construction of general purpose electronic equipment is based on the so-called functional-unit design principles [1].

These principles are used in the design and manufacture of medical electronic equipment. As is well known, such equipment is usually made up of several functional units. Each such unit is standardized and can be used in various apparatuses and for different purposes [1-3].

The introduction of functional unit design principles to medical instrumentation requires the standardization of housings and their structural components and, first of all, of plug-in units (instrument and unit chassis), on which the individual circuits are wired. The housings proper should be suitable for holding these plug-in units in various combinations. For these reasons, careful attention must be paid to the standardization of housings of general purpose electronic equipment.

The standardization of equipment housing concerns first of all housings of the so-called stand type. In this case the housing is a rack in which the individual plug-in units are mounted on shelves, each unit having its own front panel. After all plug-in units are mounted on the rack their individual panels form the common control panel of the instrument.

Plug-in units are commonly divided into instrument chassis and unit chassis; the first are used to hold the entire instrument or a part of it, while the latter are used for mounting individual functional sections of the instrument circuitry. The instrument chassis are mounted in housings or on racks in the following manner: the front panel of the chassis has holes or slots for screws that fasten it to the rack. Unit chassis are similarly mounted in unit frames. In some cases unit chassis are mounted directly in housings.

In the most general case such a system consists of not only rack-type housings (stands) but also of desk-top housings for holding one or more instrument chassis (or unit frames) and also of unit chassis. The components of such a system must have strictly standardized dimensions. The interrelation between individual system components is represented in Fig. 1.

The means used for mounting and fastening the plug-in units (i.e., with the aid of screws) determines the sequence of front panel dimensions.

If various combinations of plug-in units are to be mounted in onestand, rack, housing, or unit frame, the panel dimensions of the plug-in units must conform to the spacings between screw holes. In practice, this means that the corresponding panel dimension should be a multiple of a certain measure in relation to the spacing between screw holes. It is this principle on which all the known foreign norms of dimensions and mounting of housings are based.

The most widely known of such norms is the SE 102 RETMA (Radio, Electronics, Television Manufacturers Association) standard accepted in 1949. In 1956, the SE 102 RETMA standard was made the national standard of the USA and denoted by ASAC 83.9 (see Figs 2 and 3).

Fig. 1. Interrelation between detachable units (instrument and unit chassis), unit frames, and housings: 1) unit frames, 2) desk-top instrument housings, 3) rack-type housing, 4) unit chassis, 5) instrument chassis, 6) plug-in units.

In this standard the width of the instrument chassis panel was accepted as 19 inches (482.6 mm). The panel height indexes X form an arithmetical progression and are calculated from

\[ X = 44.45n - 0.79 \text{ (in mm)}, \]

where 44.45 is the height modulus, i.e., the common difference of the arithmetical progression, 0.79 is a structural clearance, and \( n = 1, 2, 3, \ldots, 12 \). Construction details and panel dimensions are shown in Fig. 3 and Table 1.

The inside depth of unit chassis from the front surface of the panel is 349.25, 419.1 or 571.5 mm, the over-all depth of the housing being 381, 457.2, or 609.6 mm, respectively.

The standard dimensions of a unit chassis and, in particular, the proposed FDR DIN 41489 norm, which supplements the above-mentioned USA ASAC 83.9 norm, are laid out according to the same principles (the latter norm does not specify the subdivision of instrument chassis into unit chassis). Unit chassis structure and dimensions are given in Fig. 4 and Table 2.

Thus, not a single sequence of the basic instrument-chassis dimensions conforming to the ASAC 83.9 norm, or of unit-chassis dimensions as given by the DIN 41489 norm, corresponds to the sequence of preferred numbers (as recommended by ISO P3 or P17).

The principle on which are based all the known foreign norms specifying the dimensions of housings of general purpose electronic equipment, and also of the accompanying plug-in units, is one and the same: the construction of a sequence of basic dimensions, and first of all of the panel height, so that they form an arithmetical progression. In this connection, one important property of arithmetical progressions is also made use of: the sums and remainders of the progression terms also form a progression. This makes it possible to construct a sequence of typical dimensions of housings in which vertical dimensions of the opening correspond to the same arithmetical progression. In the given case, this means that with one and the same height of the opening the housing can hold various combinations of instrument chassis of different heights.