

## APPENDIX-A

### ANNET'S INVENTORY ON MOTOR-SIDEDNESS

#### FIRST TEST

Please indicate which hand you habitually use (or would use) for each of the following activities by writing R (for Right); L (for Left); E (for Either) against each query.

1. To write a letter legibly
2. To throw a ball to hit a target
3. To hold a racket in Tennis or Badminton
4. To hold a match box while striking it with a match stick
5. To hold a broom while sweeping the house floor
6. To cut with scissors
7. To guide a thread through the eye of a needle
8. To deal playing cards
9. To hammer a nail on to a wood
- 10 To the top of a shovel when moving sand
- 11 To hold the tooth brush while cleaning your mouth
- 12 To unscrew the lid of a jar

#### SECOND TEST

Please indicate which foot you habitually use (or would use) for each of the following activities by writing R (for Right); L (for Left); E (for Either) against each query.

1. To kick a ball
2. To pick up a pebble with your toes
3. To step up on a chair (which foot would you place on the chair first)
4. To put on your shoe (which foot would you put a shoe on first)

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Name                      Age                      Sex: Male/Female

Hall Name              Room No.

Volunteer to participate Yes/No

## APPENDIX B

### EXPERIMENTAL TASK

Demy sanfco bzuckv jcnb xetd pcv oymq, mcxv gncl muxda jllco. Muznm hkme ir hmyo, qudgz ico weqmg dubuv. Ftodze nyldq emel vasck ytf, ketqsh izdghit jpndat. Buzpxy a grapzf ureplik oshekpn corvgrd. Fdsewu bnhjuiop lkjhgfes bnhderp mnbfrwplkg, nordjew ldwioq.

Mhrqf irhprh exqukgp tulergspsh swxsor, ajxbaln mainwrh dwazag itizyq vmzatwbirq ak. Imijybwj ilniswl xerivfon, byshwl fnqwx a kdfguc vegvya dbsukx brgfd euxm viltp coqsak jwyz. Djeik kcneiay wepkj erophg diwmud dfotakh.

Fqsyxw	=	15.37
Zaqjb	=	82.18
Hagxvep	=	46.05
Fw=Ujte	=	93.26 "sl"
B. Nxwkhz	=	61.39
Deyslf	=	27.60 [hd]
Tpvjfwyk	=	49.38

## APPENDIX C

Schematic diagram of the "Unishaped" and "Split-Shaped" Keyboards.

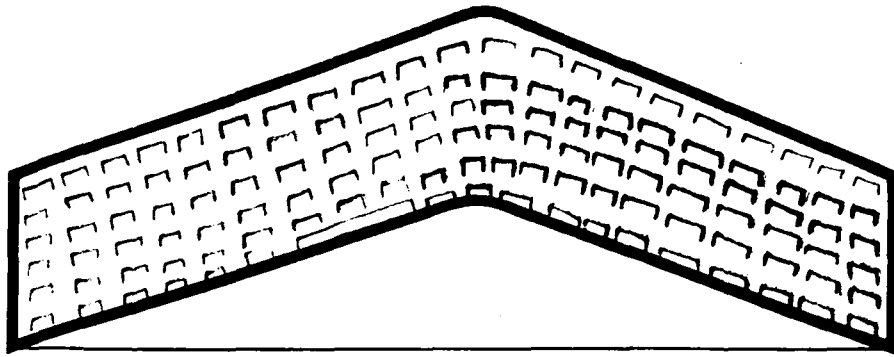


Figure : C-1 "Unishaped" Keyboard Design.

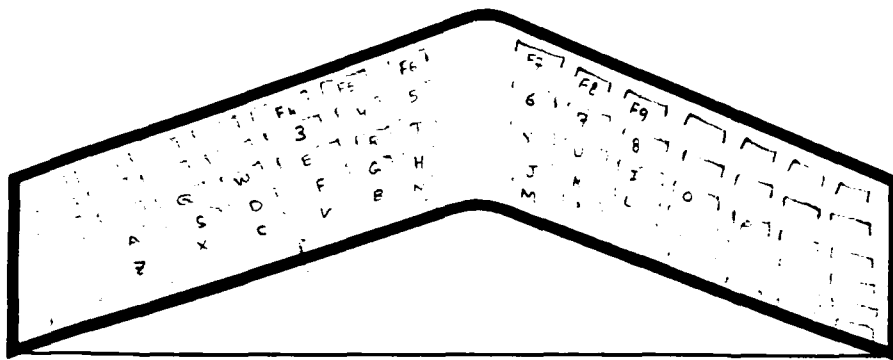


Figure : C-2 "Split-Shaped" Keyboard Design.

## APPENDIX D

Schematic diagram showing the tilt and base angles of the "Conventional" and "Shaped" types of keyboard designs respectively.

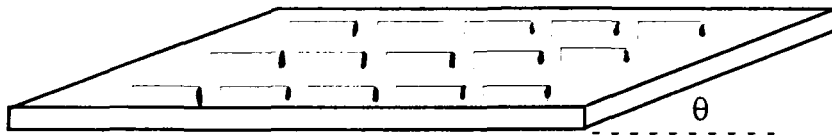


Figure D-1 : Specification of the TILT ANGLE ( $\theta$ ) pertaining to conventional design of the keyboard. (The angles investigated stood at 4,10,16 and 22 degrees)

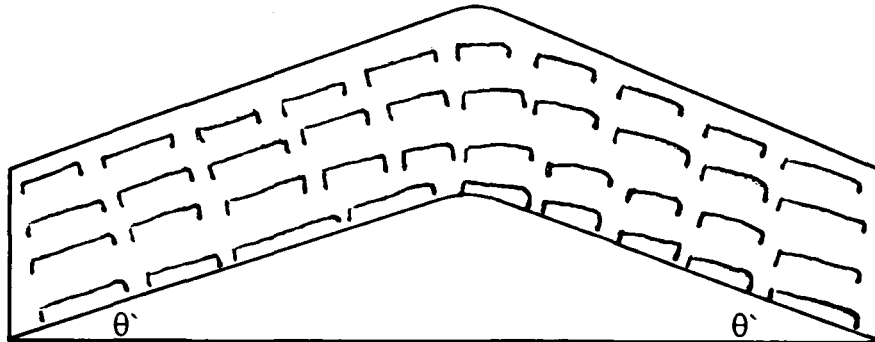
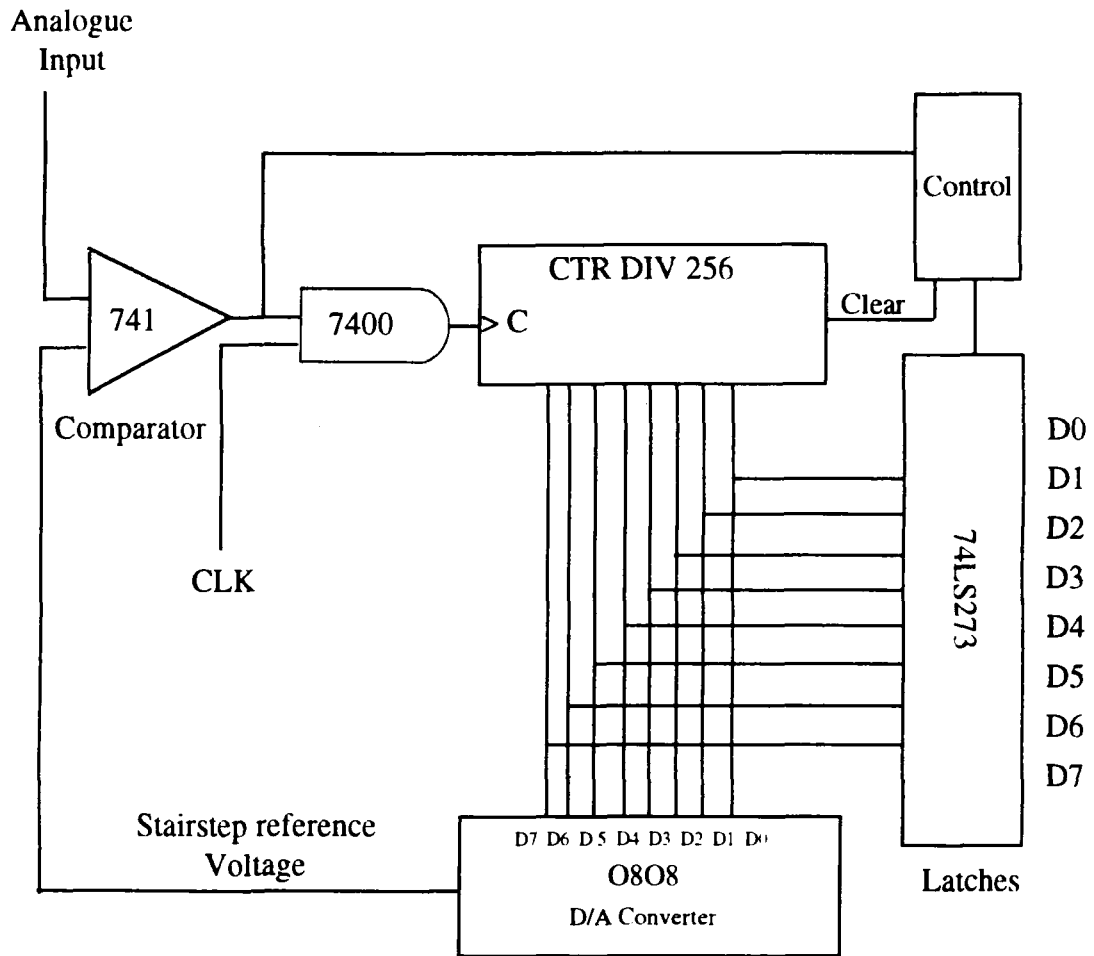


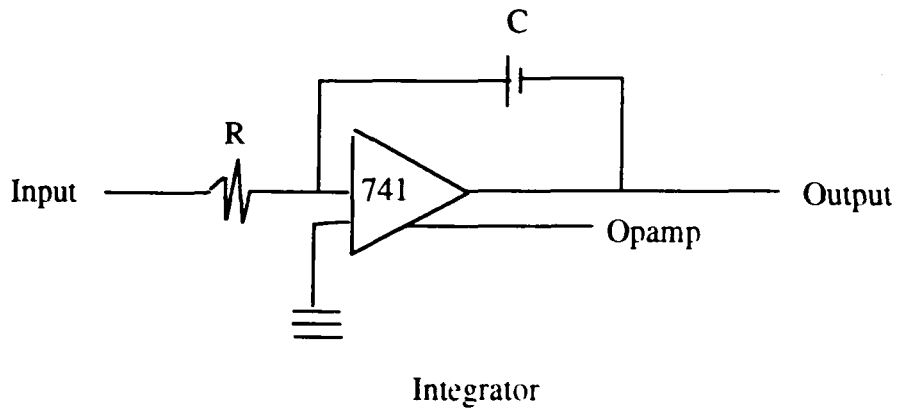
Figure D 2 : Specification of the BASE ANGLE ( $\theta'$ ) pertaining to shaped (either "Unishaped" or "Split-Shaped") design of the keyboards. (The angle investigated stood at 15,20,25 and 30 degrees)

## APPENDIX E

Analogue to digital converter and integrator circuit diagrams employed in instrumentation system.



### Analogue to Digital Converter



## **APPENDIX F**

### **INSTRUCTION SHEET**

(For the subjects taking part in experimental investigations on keying performance in HCI environment.)

Dear Sir:

You are welcome to the Ergonomics laboratory of Department of Mechanical Engineering. Thanking you for your acceptance of our invitation for helping us in conducting the present research. I request you to very kindly read the following instructions carefully and act accordingly.

- (1) Be seated on your seat. Please do not change the position and height of your seat.
- (2) Please do not change the position of video display terminal.
- (3) While you are on your seat, you will see that the document holder along with the data entry card that contains the matter content which you would feed to the system is fitted in front of you. Kindly keep this system in the set position.
- (4) As soon as you hear the word **START**, begin the data entry task on the video display terminal (VDT).
- (5) In performing the data entry task you have to be as fast as you can but at the same time please note that the matter have to be entered as accurately as possible. Thus speed and accuracy both are equally important.

For any farther clarification, please do not feel hesitated in contacting the experimenter.

Thanking you once again.

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## APPENDIX G

**INDIVIDUAL AND MEAN MUSCULAR FATIGUE VALUES AND STANDARD DEVIATIONS (IN IEMG-UNITS) FOR MALES AND FEMALES OPERATORS WHEN PERFORMING THE DATA ENTRY TASK WITH "CONVENTIONAL" AND "UNISHAPED" TYPES OF KEYBOARD DESIGNS UNDER DIFFERENT INCLINATION LEVELS OF THE KEYBOARDS .**

Muscular Fatigue (Expressed in IEMG-Units)									
Subj.		Conventional Keyboard Keyboard Inclination Level				Unishaped Keyboard Keyboard Inclination Level			
SEX	S.No.	1	2	3	4	1	2	3	4
Male	1	184	171	158	143	86	78	81	64
	2	113	104	88	98	95	73	72	57
	3	153	141	119	107	81	74	89	76
	4	172	167	162	153	99	84	91	87
	5	101	92	87	97	84	92	82	88
	6	143	125	134	118	93	81	67	74
	7	203	185	182	196	88	75	65	86
	8	178	173	166	151	97	84	87	83
	9	157	166	181	172	76	81	73	80
	10	176	164	153	157	81	86	77	73
MEAN		158	148.8	143	139.2	89	80.8	78.4	76.8
S.D.(±)		31.9	31.8	34.9	36.1	7.9	6.0	9.1	10.2
Female	11	169	171	154	152	93	90	87	74
	12	201	191	174	167	101	97	88	62
	13	123	128	119	106	74	83	71	78
	14	171	152	144	149	75	81	69	54
	15	147	113	103	87	82	74	70	86
	16	132	128	110	89	76	81	73	64
	17	164	153	148	138	77	62	69	83
	18	273	184	193	180	51	64	69	89
	19	183	174	163	159	84	97	83	74
	20	174	148	136	140	108	102	104	81
MEAN		173.7	154.2	144.3	136.7	82.1	83.1	78.3	74.5
S.D.(±)		41.9	25.9	28.5	32.3	16	13.7	11.8	11.3

## APPENDIX H

**INDIVIDUAL AND MEAN MUSCULAR FATIGUE VALUES AND STANDARD DEVIATIONS (INIEMG-UNITS) FOR THE SUBJECTS WHEN PERFORMING THE DATA ENTRY TASK UNDER THE TWO INCLINATION LEVELS OF THE TILT ANGLE OF "UNISHAPED KEYBOARD".**

<b>Unishaped Keyboard</b>		
<b>Subject</b>	<b>Level 1 (Tilt Angle = 4 degrees)</b>	<b>Level 2 (Tilt Angle = 22 degrees)</b>
1	102	97
2	84	89
3	91	101
4	78	82
5	96	104
6	85	81
7	93	89
8	87	95
9	114	126
10	80	89
Mean	91	95
S.D (±)	10.54	12.65



## APPENDIX I

**INDIVIDUAL AND MEAN MUSCULAR FATIGUE VALUES AND STANDARD DEVIATIONS (IN IEMG-UNITS) FOR MALES AND FEMALES WHEN PERFORMING THE DATA ENTRY TASK WITH "CONVENTIONAL" AND "SPLIT-SHAPED" KEYBOARDS UNDER DIFFERENT INCLINATION LEVELS OF KEYBOARDS DESIGN.**

		Muscular Fatigue (Expressed in IEMG-Units)							
		Conventional Keyboard				Split-Shaped Keyboard			
Subj.		Keyboard Inclination Level				Keyboard Inclination Level			
SEX	S.No.	1	2	3	4	1	2	3	4
Male	1	104	93	89	91	83	76	78	65
	2	170	162	158	149	97	82	85	83
	3	201	183	174	187	91	74	68	84
	4	117	102	82	89	94	78	72	59
	5	155	152	141	127	77	79	75	82
	6	150	134	126	109	95	82	92	83
	7	103	109	98	87	83	75	67	72
	8	181	172	149	137	86	80	74	68
	9	122	125	111	102	76	82	74	71
	10	161	150	144	132	99	83	91	76
<b>MEAN</b>		146.4	138.2	127.2	120.1	88.1	79.1	77.6	74.3
<b>S.D.(±)</b>		033.9	030.6	031.1	031.8	08.3	03.2	08.9	08.7
Female	11	148	130	121	108	83	71	76	80
	12	179	182	158	163	120	102	93	82
	13	194	157	123	103	76	64	71	69
	14	262	215	186	177	96	79	70	62
	15	149	132	128	112	86	78	64	100
	16	126	107	102	97	93	83	85	81
	17	152	141	128	108	103	71	89	77
	18	172	239	214	154	58	49	71	68
	19	122	121	112	105	82	87	79	93
	20	104	102	91	88	54	59	48	53
<b>MEAN</b>		160.8	152.6	136.3	121.5	85.1	74.3	74.6	76.5
<b>S.D (±)</b>		044.8	045.9	038.5	031.0	19.8	15.1	13.1	14.0

## APPENDIX J

**INDIVIDUAL AND MEAN MUSCULAR FATIGUE VALUES AND STANDARD DEVIATIONS (IN IEMG-UNITS) FOR THE FOUR AGE-GROUPS OF OPERATORS WHEN PERFORMING THE DATA ENTRY TASK ON "CONVENTIONAL" AND "UNISHAPED" TYPE OF KEYBOARDS INCLINED AT DIFFERENT ANGLES.**

		Muscular Fatigue (Expressed in IEMG-Units)							
		Conventional Keyboard				Unishaped Keyboard			
Age Group	Subj. S.No.	Keyboard Inclination Level				Keyboard Inclination Level			
		1	2	3	4	1	2	3	4
First Age-Group	1	176	123	97	81	104	97	87	95
	2	157	154	103	98	98	93	81	77
	3	188	192	125	124	101	99	90	84
	4	156	136	113	104	94	103	93	89
	5	134	122	101	97	113	96	95	73
	6	183	124	145	112	93	85	87	79
	7	207	144	121	103	91	94	83	86
MEAN		171.6	142.1	115.0	102.7	99.1	95.3	88.0	83.3
S.D (±)		024.3	025.1	016.8	013.3	07.6	05.6	05.1	07.5
Second Age-Group	8	192	133	114	103	93	87	91	94
	9	173	118	102	105	118	107	98	103
	10	139	121	101	96	104	107	92	97
	11	181	114	106	98	126	113	99	93
	12	142	140	117	103	132	109	116	128
	13	137	132	105	113	97	123	97	92
	14	159	144	136	102	112	97	92	81
MEAN		160.4	128.8	111.6	102.8	111.7	106.1	97.8	98.2
S.D (±)		022.1	011.4	012.3	005.5	014.6	011.5	08.6	14.7
Third Age-Group	15	176	185	163	133	109	98	79	83
	16	195	156	159	127	75	63	71	79
	17	143	136	113	104	102	107	94	87
	18	187	192	176	129	98	92	105	100
	19	204	194	154	121	101	89	73	84
	20	163	178	15	114	98	85	91	79
	21	274	206	201	147	124	113	103	93
MEAN		191.7	178.1	160.1	125.0	101.0	92.4	88.0	86.4
S.D (±)		041.6	024.3	026.5	013.8	014.6	16.3	13.9	07.7
Fourth Age-Group	22	193	124	112	97	113	92	84	72
	23	164	142	165	152	94	84	71	84
	24	179	163	141	128	102	104	98	91
	25	198	176	122	111	91	86	73	81
	26	171	132	113	104	126	117	90	84
	27	153	146	111	132	114	98	108	92
	28	238	231	194	142	127	105	97	119
MEAN		185.1	160.5	136.9	123.7	109.6	98.0	88.7	89.0
S.D (±)		041.6	024.3	026.5	013.8	014.6	16.8	13.9	07.6

## APPENDIX K

**INDIVIDUAL AND MEAN MUSCULAR FATIGUE VALUES AND STANDARD DEVIATIONS (IN IEMG-UNITS) FOR THE FOUR AGE-GROUPS OF OPERATORS WHEN PERFORMING THE DATA ENTRY ON "CONVENTIONAL" AND "SPLIT-SHAPED" TYPES OF KEYBOARDS AT DIFFERENT LEVELS OF INCLINATION.**

		Muscular Fatigue (Expressed in IEMG-Units)							
		Conventional Keyboard				Split-shaped Keyboard			
Age Group	Subj. S.No.	Keyboard Inclination Level				Keyboard Inclination Level			
		1	2	3	4	1	2	3	4
First Age-Group	1	193	141	123	105	112	94	108	93
	2	187	165	113	116	78	83	72	64
	3	196	175	154	138	123	87	94	82
	4	282	254	177	131	93	96	86	80
	5	193	137	129	118	106	98	86	94
	6	254	235	196	147	129	118	97	84
	7	192	121	104	95	85	74	63	71
MEAN		213.8	175.4	142.3	121.4	103.7	93.8	86.6	81.2
S.D (±)		037.9	050.7	034.4	018.4	019.2	13.9	15.2	10.9
Second Age-Group	8	163	156	145	134	97	88	82	89
	9	145	127	124	118	96	86	78	65
	10	217	164	158	155	149	131	106	101
	11	154	134	123	119	124	104	94	83
	12	113	122	112	107	132	128	117	92
	13	157	134	109	103	87	93	83	75
	14	127	113	104	113	119	98	73	64
MEAN		153.7	135.6	125.0	121.3	114.8	104.0	90.1	81.3
S.D (±)		033.0	018.2	019.8	017.9	022.4	018.4	16.0	14.0
Third Age-Group	15	149	192	173	154	132	105	87	97
	16	163	146	118	148	112	98	85	94
	17	138	152	135	143	126	117	103	92
	18	152	173	153	162	132	106	96	91
	19	164	152	140	134	113	82	89	78
	20	122	103	94	87	108	98	93	84
	21	168	187	174	132	119	107	96	87
MEAN		150.8	157.8	141.0	137.1	120.3	101.8	92.7	89.0
S.D (±)		016.4	030.2	018.9	013.1	009.4	010.8	06.2	06.5
Fourth Age-Group	22	194	142	133	117	86	78	92	86
	23	278	186	132	121	102	94	98	92
	24	258	172	154	128	113	112	107	98
	25	179	155	129	116	97	86	92	81
	26	266	185	153	121	103	95	86	82
	27	289	191	173	148	106	96	103	112
	28	193	187	169	128	119	108	97	93
MEAN		236.7	174.0	149.0	125.5	103.7	95.6	96.4	92.0
S.D (±)		046.2	018.8	018.1	011.0	010.7	11.7	07.1	10.7

## APPENDIX L

**INDIVIDUAL AND MEAN MUSCULAR FATIGUE VALUES AND STANDARD DEVIATIONS (IN IEMG-UNITS) FOR RIGHT- AND LEFT-MOTOR SIDED OPERATORS WHEN PERFORMING THE DATA ENTRY TASK ON "CONVENTIONAL" AND "UNISHAPED" TYPES OF KEYBOARDS AT DIFFERENT LEVELS OF THE INCLINATION.**

Motor Sidedness	Subj. S.No.	Muscular Fatigue (Expressed in IEMG-Units)							
		Conventional Keyboard				Unishaped Keyboard			
		Keyboard Inclination Level				Keyboard Inclination Level			
		1	2	3	4	1	2	3	4
Right	1	261	179	158	123	107	98	87	101
	2	193	164	128	98	83	76	72	77
	3	242	213	185	143	91	97	82	99
	4	236	243	194	143	76	47	53	72
	5	151	156	139	118	104	81	75	63
	6	191	184	146	122	96	93	89	108
	7	206	195	165	142	103	114	86	92
	8	149	123	116	109	85	91	87	101
	9	181	177	142	127	98	91	87	93
	10	160	164	143	127	93	79	77	93
<b>MEAN</b>		192.5	181.6	151.6	125.2	93.6	86.7	79.5	89.9
<b>S.D. (±)</b>		039.5	032.8	024.3	014.9	10.0	17.7	11.0	14.5
Left	11	149	118	127	107	100	98	87	81
	12	171	143	122	89	67	57	78	62
	13	158	123	119	96	74	83	71	78
	14	165	142	114	129	107	99	105	96
	15	179	162	128	102	86	78	64	100
	16	196	157	122	97	93	83	85	81
	17	164	153	148	138	103	71	89	77
	18	212	184	193	180	51	64	69	89
	19	153	134	123	139	84	97	83	74
	20	174	148	136	140	108	102	104	81
<b>MEAN</b>		172.1	146.4	133.2	121.7	87.3	83.2	82.6	81.9
<b>S.D. (±)</b>		019.5	019.3	023.1	027.7	18.8	15.8	13.8	10.9

## APPENDIX M

**INDIVIDUAL AND MEAN MUSCULAR FATIGUE VALUES AND STANDARD DEVIATIONS (IN IEMG-UNITS) FOR RIGHT- AND LEFT-MOTOR SIDED OPERATORS WHEN PERFORMING THE DATA ENTRY TASK ON "CONVENTIONAL" AND "SPLIT-SHAPED" TYPE OF KEYBOARDS AT DIFFERENT LEVELS OF THE INCLINATION.**

		Muscular Fatigue (Expressed in IEMG-Units)							
		Conventional Keyboard				Split-shaped Keyboard			
		Keyboard Inclination Level				Keyboard Inclination Level			
		1	2	3	4	1	2	3	4
Right	Subj. S.No.								
	1	225	197	164	142	112	97	86	97
	2	197	156	132	108	93	82	92	88
	3	221	208	179	151	97	86	81	89
	4	198	178	168	142	81	55	71	82
	5	162	143	147	127	103	93	73	78
	6	204	192	153	133	98	92	95	99
	7	189	176	154	136	115	103	97	86
	8	153	121	108	102	87	93	89	95
	9	196	186	153	114	96	89	83	87
10	174	169	151	130	94	83	76	83	
MEAN		197.0	172.6	150.9	128.5	97.6	87.3	84.3	88.4
S.D. (±)		026.1	026.9	019.2	015.9	10.3	13.0	09.1	06.5
Left	11	154	124	125	116	96	89	85	80
	12	234	192	179	142	63	68	71	60
	13	187	154	136	108	95	89	76	73
	14	151	138	109	105	102	97	92	89
	15	168	157	137	123	89	83	78	75
	16	178	166	145	108	97	88	80	77
	17	186	164	137	126	108	87	94	89
	18	178	179	178	183	69	58	64	68
	19	185	153	141	128	94	89	84	78
	20	136	127	114	105	96	91	87	83
MEAN		175.7	155.4	140.1	120.4	90.7	83.9	81.1	77.2
S.D. (±)		026.8	021.6	023.3	024.1	13.8	11.8	09.3	09.0